August 1961

Electrical South

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In this issue:

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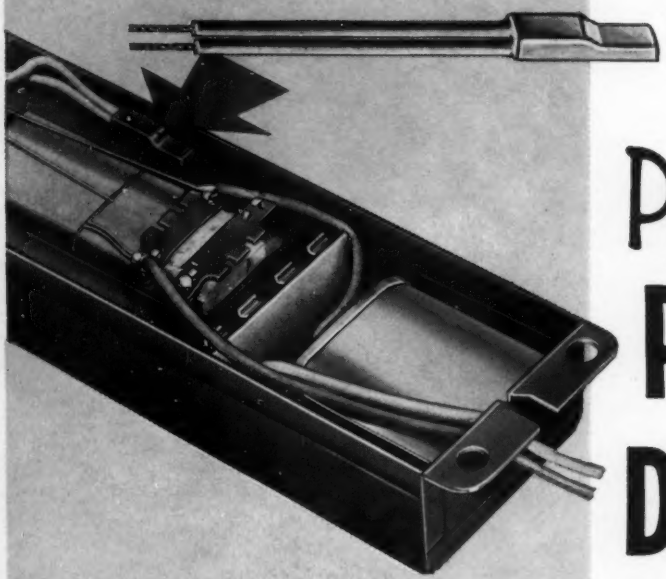

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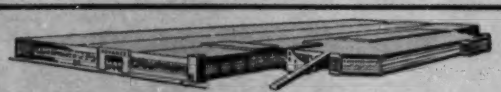

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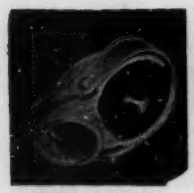
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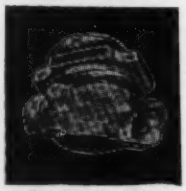
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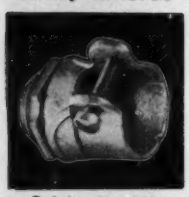
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FRONT COVER — Determined not to lose out on the electric heating boom, the Tampa Chapter, Florida Association of Electrical Contractors has developed a program of electric heat promotion which includes a certification program. Photo shows portion of extensive exhibit at the state fair.

Electrical South

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Economic comment

by J. Whitney Bunting, Ph.D.
Contributing Economics Editor

A quiet economy

Although many economic forecasters predicted that any business upturn in 1961 would be a slow and steady affair, few really recognized the almost slumberous condition that has been evident during the last few weeks. Certainly there have been signs of recovery and the indices of business activity show unmistakable portents of better things to come. But there is almost a drowsy quality associated even with these good signs.

An example is the consumer spending pattern.

Wages and salaries have managed to remain quite high during 1961, and reports from Washington continue to record highs in employment. But there is still an unhappy amount of unemployment, particularly in certain depressed regions of the nation. This amount should not cause any great negative reaction upon consumer activity. However, the retail stores have not experienced the stimulating surge of buyer demand that might spark the recovery that all would like to see arrive.

It is comforting to realize that consumer activity is at least holding firm and that delayed buying may have g r e a t e r financial strength in the long run when supported by an increased level of personal savings. This is somewhat the same pattern that prevailed after World War II but for different reasons. Then a protracted period of decreased civilian production had created an artificial scarcity of most consumer items. This factor, coupled with the forced savings so necessary in a wartime economy, created a demand backed up by purchasing power that was enough to create buoyant economic conditions.

Now, there is no real scarcity of consumer goods, but buyers have exercised extreme caution to the end that much demand has been withheld from the market place. When consumers overcome this temporary restriction upon spending, since it is voluntary on their part, a similar expansion of retail activity should take place.

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

Future omens good

Looking on into the future, it should be very evident that with proper care prosperous conditions can be anticipated to last for some time. There is much comment today about the over-capacity of American industry and the fact that many corporations built too many new facilities during the past five years. The truth of the matter is that it would not take too much increased demand to make this over-capacity a thing of the past.

In fact, if consumer demand rose to be commensurate with current employment and earnings, there would be few plant facilities that would not be utilized to full capacity. Beyond this point would be the demand for more new facilities to care for the growing consumer demand for new goods and products. And this statement is not visionary.

There are many reasons for this projected upsurge toward an unprecedented period of prosperity in the United States. Basically, of course, there is the inherent strength of the competitive enterprise system and the industrial foundation that it has nurtured during the course of American history. No other ideology has proven itself capable of developing such a wide diversity of goods and services.

But in addition to this solid foundation there are other factors that bear mention for they contribute the dynamics to the development process just now getting underway. First, there is the tremendous upsurge of population in this country that is creating new consumers both individually and as family units. Each person creates new demands upon the economic system both for products to consume and as an economic producer. Thus, the market for the products of American industry continues to grow and must be served.

This creates a responsibility on business leadership for, with rising living standards, the demands for products will increase even faster than the supply of labor available. Automation and new productive techniques are a "must" in the years ahead for otherwise all types of economic problems could well emerge.

Second, the challenge just mentioned can only be met by the continued accent on American ingenuity for research and development. This nation has been blessed by a greater than average supply of talented inventors and new product development specialists. A large number of products on the market today were completely unknown a scant ten years ago. Yet the American people accept such products as indispensable items for their daily living experience.

This characteristic of the American person will aid the nation's economy greatly if it can be directed both toward the development of new products and toward the development of new techniques for better industrial production. In fact, the latter factor may be one of the keys to the rate of economic expansion that can be anticipated.

Danger of inflation

Third, the United States must hold fast against the inroads of inflation. Inflation has been slowly moving into the economic scene and could well become one of the prime hazards in the next few years. American industry has been faced with increased foreign competition in both foreign and domestic markets.

Part of the difficulty has been the lower costs of production (principally labor) that many foreign producers enjoy. With the rapid rise of industrial productivity in European nations, there has been a concurrent process of inflation, thus reducing in fact some of the advantages these producers enjoy. If the United States can resist pressures toward further inflation and, if the current trend continues overseas, then it may

(Continued on page 69)

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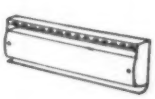

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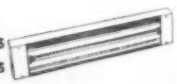

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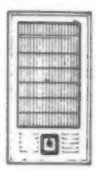

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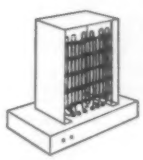

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Washington report

By Jack James

Digest of Washington news of special significance to the electrical industry

Construction climbs in 1961, housing boom seen for 1962

RECORD NEW CONSTRUCTION, ranging in value between $57 billion and $57.8 billion, is predicted for 1961 followed by a housing boom in 1962.

The record will be set with only slight aid from the $9 billion Kennedy Housing Bill that became law last month. Impact of this legislation will be about $¼ billion this year. Full impact will be in 1962 and the following four or five years.

These are opinions of several construction economists, government and private, in Washington.

Housing, which accounts for close to one third of new construction, will come out of its slump in the second half of 1961, the economists say. It will help nudge new construction to a record high.

When the full impact of the new Kennedy Housing Bill is felt next year, coming on top of this year's upswing, it will push housing to "a banner year." Economists at the Associated General Contractors and the U.S. Department of Commerce are in close agreement on these points.

James D. Marshall, executive director, Associated General Contractors, said that a bigger supply of mortgage money and easier interest rates will increase housing starts in the second half of 1961.

"Next year," he said, "should be a banner year for residential construction."

Despite the eight per cent slump in the first half of this year, compared with 1960, Mr. Marshall said that total value of new construction this year would hit $57 billion. In all major categories except housing, he said, construction is running ahead of its 1960 pace.

The record for new construction is $56.2 billion in 1959. Last year the amount was $55 billion.

The Department of Commerce was slightly more optimistic than Mr. Marshall. The Department said that new construction this year would hit $57.8 billion. Like Mr. Marshall, the department foresees a "significantly better volume of housing starts . . . in the last six months of 1961." And, according to the department, "the stronger trend indicated for the last part of this year promises a substantial carry-over of expenditures into 1962."

Kennedy housing bill effect will cover five-year period

IMPACT of the new Kennedy housing legislation will be spread over the next four to five years. The reason is that a major part of the legislation concerns urban renewal, public housing, college dormitory loans, and the like.

Months of planning are required for such projects; and even before this planning can start, several other months may pass. Government bureaus that will administer the many new and changed laws (160 printed pages) must set up regulations and working rules. In some cases, additional state legislation will be needed.

The full impact of the new laws can only be guessed at. Some predict as much as $9 billion in new construction. Although this sum seems vast, it would be a relatively small part of total construction. The $9 billion under the new laws would be spread over four to five years.

Highlights of new legislation show more payment leniency

NO ONE YET knows exactly how the new housing laws will work.

"Right now we're in a maze," an official of the National Association of Home Builders said. "We're trying to explain to our members what the Federal Housing Administration hasn't explained to us yet, so we're still groping around."

However, here are some of the key parts: (1) public housing loan authorization for moderate income families (formerly public housing was only for low income families); (2) lower down payments, longer terms (up to 35 years) on FHA mortgages; (3) for middle income families, three per cent down payments on 35-year loans on homes up to $15,000 in value; (4) for single family homes over ten years old, $10,000, 20-year repair loans at six per cent interest—in urban renewal areas, similar loans for multi-family houses; (5) unlimited authority for the FHA to insure mortgages until October 1, 1965; (6) $2 billion in grants for urban renewal; (7) an additional $336 million for public housing, enough to build about 100,000 units (this does not cover the public housing program for moderate income families which would be financed by loans rather than by grants); (8) a four-step increase over the next four years in the authorization for loans for college dormitories from $1.7 billion to $2.9 billion; and (9) for farm housing loans, another $200 million.

Home repair market rates close to new home spending

THE HOME REPAIR MARKET is almost as big as the new home market, according to the U.S. Department of Commerce. In 1960, $13 billion was spent for residential upkeep and improvement. The amount is about 75 per cent of that spent on new dwellings that year.

The average expenditure by an owner during the year was $298. Spending was seasonal. Average amount spent by an owner in the first three months was $54; in the second three months, $83; in the third, $85; and the fourth, $76.

Owner-occupants of one to four family housing units spent $9,441 million on upkeep. Nonresident owners of one to four family units spent $2,399 million. Owners of larger units (resident and nonresident) spent $885 million. Renters spent $395 million.

Tax plan for aiding economy dies from business opposition

THE TAX PROGRAM designed by the Kennedy administration to help economic growth appears dead. The program met solid opposition from business spokesmen. Some 200 witnesses testified before the House Ways and Means Committee, most against the program. They called it complicated and discriminatory.

(Continued on page 118)

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CONDUIT AND DUCTS—Orangeburg Mfg. Co., Inc., 375 Park Ave., New York 22, N. Y. has made available informative literature. Catalog No. 52 includes complete details concerning advantages, installation, and properties of Orangeburg fibre conduit, standard conduit—type I, and Nocrete conduit—type II. Catalog 202 offers specifications, installation data, and diagram of the complete Orangeburg Underfloor duct system. Descriptions and catalog numbers of components are also given.

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ELECTRIC HEATING—A 34-page descriptive packet containing color illustrations and complete specifications of eight major types of electric heating units and controls is now available from Arvin Industries, Inc., Electric Heat Div., 13th and Big Four Road, Columbus, Ind. Both radiant and fan-forced heaters are included, in wall, baseboard, and ceiling models.

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WIRING DEVICES — Catalog No. 56, and New Products Bulletins, containing the complete electrical wiring device line of Leviton Mfg. Co., Inc., Brooklyn 22, N. Y. Over 100-pages accurately illustrated and containing electrical and circuit wiring diagrams. Complete cross index for easy reference. Featured are Specification Grade Devices, Interchangeable line, Lev-O-Lock line, and many, many others; devices for every possible use in Industrial, Commercial and Residential applications.

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CARBON PRODUCTS—A 28-page catalog on Motor and Generator Brushes and carbon products telling how to order brushes, grade recommendations, characteristics, and description of brush grades, is available from the Helwig Co., 2536 North 30th St., Milwaukee, Wis.

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LIGHTING FIXTURES—Progress Manufacturing Co., Castor Avenue and Tulip Street, Philadelphia 34, Pa., announces the publication of two new lighting catalogs. "Lighting by Progress," a 52-page booklet, describes their line of residential fixtures. "Home Lighting by Minute Mount" is a 12-page bulletin illustrating new ideas in budget lighting.

Write in No. A139 on card, pg. 17

CABLE, WIRE, AND CORD—Catalog 71A, punched for filing in looseleaf binder, has been made available by Carol Cable Co., Division of the Crescent Co., Inc., Pawtucket, R. I. Contained in its 24 pages is a complete listing of most of the types of wire and cable offered by the firm.

Write in No. A140 on card, pg. 17

ELECTRICAL EQUIPMENT—The Wadsworth Electric Mfg. Co., Inc., Covington, Ky., has issued a new catalog 58' Guide, containing data on their line of Safety Switches, Service Equipment, Distribution Panels, "E-Z-RED" Circuit Breakers, interchangeable and non-interchangeable, also wiring troughs.

Write in No. A141 on card, pg. 17

POWER BENDER — The lightweight hydraulic power bender #884, manufactured by Greenlee Tool Co., of Rockford, Ill., is described in a new bulletin issued by the company.

Write in No. A142 on card, pg. 17

ELECTRICAL FITTINGS—Concise 36-page catalog illustrates and describes a complete line of electrical fittings, cable racks and wiring specialties. The catalog contains many detail drawings, clear-cut photographic illustrations of mast fittings, cable connectors, traps, hangers and ground clamps in a wide variety of types and sizes. For your free copy, write The M. & W. Electric Mfg. Co., East Palestine, Ohio.

Write in No. A143 on card, pg. 17

COMPRESSION CONNECTORS — New and fully illustrated Bulletin 13 offered by the James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo., shows their complete line of Squeezon compression fittings. They make all overhead distribution connections from line wire to ground rod on aluminum, ACSR, copper, or combinations of them. Application and installation data are given for tap connectors of several types; service entrance, splicing, jumper and repair sleeves; terminals, stirrups and ground fittings. Mechanical and hydraulic installing tools for both dead and hot line work are listed.

Write in No. A145 on card, pg. 17

WATER HEATING BOILER — Precision Parts Corp., 400 N. First St., Nashville 7, Tenn., has available a bulletin containing catalog information on their electric hot water heating boiler, diagrams of the boiler, and data on the advantages of its use. The boiler comes complete with water circulator and safety valve on models A through K.

Write in No. A146 on card, pg. 17

ADEQUATE WIRING — "Bright Ideas for Ladies" is the title of a new booklet from American Metal Moulding Co., 146 Coit St., Irvington 11, N. J. The booklet was prepared by the Armoured Cable Section of the National Electrical Manufacturers Association to acquaint homemakers with the electrical wiring their homes need for full electrical living now and in the future.

Write in No. A147 on card, pg. 17

ELECTRICAL CONDUITS — "National Electric Conduits" is the 20-page Catalog No. 603 which describes and illustrates the many types of electrical conduits manufactured by National Electric Div., H. K. Porter Co., Porter Bldg., Pittsburgh 22, Pa.

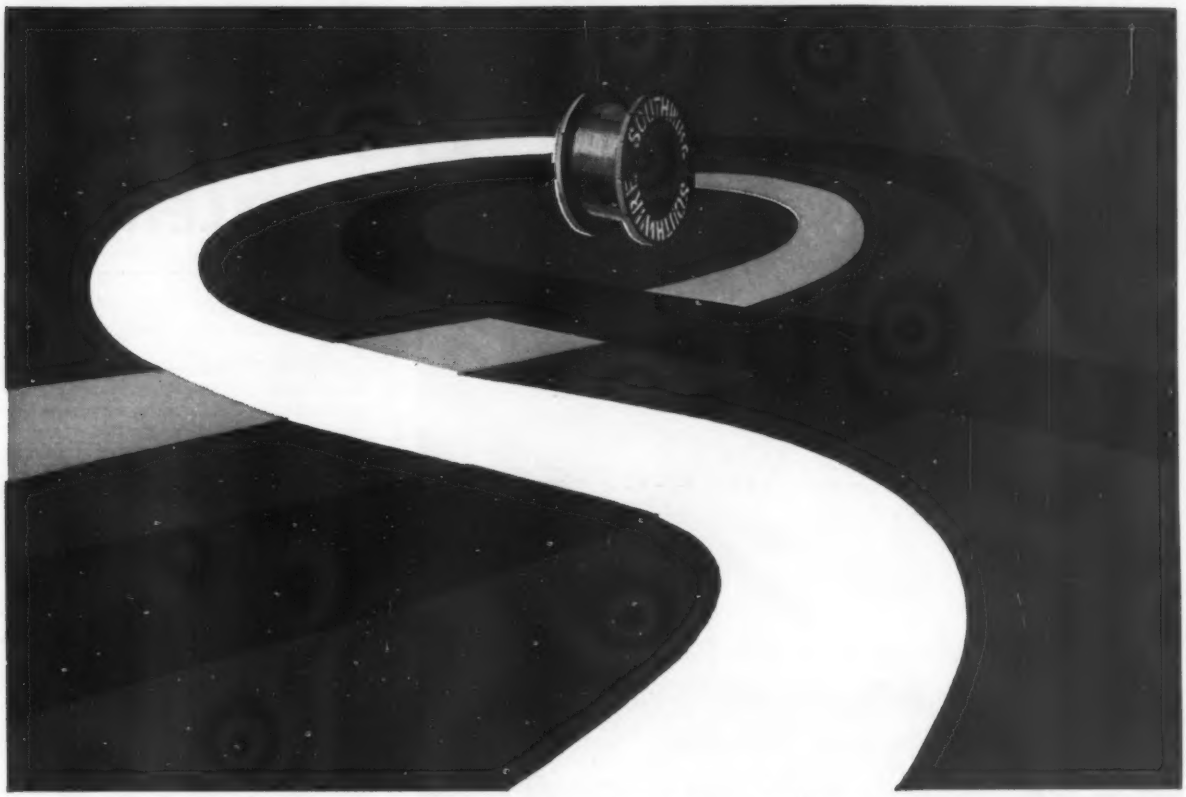
Write in No. A148 on card, pg. 17

TRANSFORMERS—R T & E Corp., 1900 E. North St., Waukesha, Wis., has available a bulletin describing Terra-Tran transformers for residential underground distribution. The 15-page booklet is illustrated and contains complete information on construction, application, and design features.

Write in No. A149 on card, pg. 17

ANCHORING DEVICES—An Illustrated 32-page catalog, No. 70, describing more than 25 anchoring and drilling devices for making fastenings to masonry, is available from the Arro Expansion Bolt Co., Marion, Ohio.

Write in No. A150 on card, pg. 17



YOU CAN'T WAIT FOR THE WORLD TO BEAT A PATH THESE DAYS

"If a man can make a better mousetrap than his neighbor, though he builds his house in the woods, the world will make a beaten path to his door."

With respect to Ralph Waldo Emerson, competition being what it is in the twentieth century, Southwire has pressed his advice a step further. We have not only endeavored to make better products, but we have also succeeded in . . .

- Operating the industry's largest fleet of trucks for fast delivery to customers' warehouses and jobsites.
- Maintaining flexible manufacturing schedules to meet needs of customers on short notice.
- Pioneering continuous aluminum casting.
- Developing the first 11,000-pound coil of aluminum rod.
- Developing new products through basic research—including 100% free-stripping Neoprene.
- Acquiring a list of loyal customers, of whom we are justly proud.

That our customers have benefited from these achievements is borne out of their use of Southwire products and the consequent growth of our company, which is 25 times larger today than ten years ago.

Specify Southwire and we'll beat a path to your door.

Southwire Company

Carrollton, Georgia — TErrace 2-6311

SOUTHWIRE serves the world

For more details on above items, use reply card on page 17

NEW!

LINE-FLEX®

CABLE SUSPENSION SYSTEM

...for industrial, mining and other applications

CHECK THESE ADVANTAGES—

★ NO INSTALLATION EQUIPMENT NEEDED!
★ SAVES TIME—CUTS LABOR COSTS!
★ DESIGNED FOR FLEXIBLE OR RIGID USE!
★ PERMITS INCREASED CURRENT-CARRYING CAPACITY!

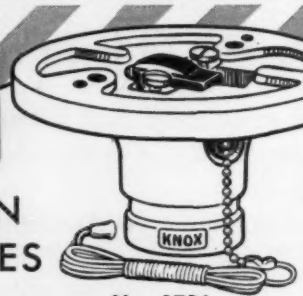
Unique, lightweight LINE-FLEX offers obstacle-avoiding flexibility in one plane and non-sag rigidity in the other! Requiring no special equipment, tools or training to install, it can be used in non-supported rigid lengths of up to 14 ft. or in catenary applications of up to 400 ft. **INSTALLS IN UP TO 25% LESS TIME!** Several hundred feet of cable can be pulled through up to three 90° bends by a 2-man crew without damage or distortion. Available in 2, 3 and 4"-dia. Galvaneal or Stainless Steel with full line of fittings and accessories.

INVESTIGATE LINE-FLEX! **WRITE FOR FREE CATALOG TODAY!**

LINE-FLEX DIVISION OF
PERFECT-LINE MANUFACTURING CORP.
OLD COUNTRY ROAD & RAILROAD AVE. • HICKSVILLE, N. Y. • WE 1-3330

NONE BETTER *than* KNOX

PORCELAIN RECEPTACLES



No. 1736

No. 1924

OPEN-TOP WIRING — ready for immediate wiring — speedy and easy installation without removal of the interior mechanism. DUST-PROOF (Completely enclosed) INTERIORS with extra large binding head screws that are backed out and staked. Replaceable interior gives absolute satisfaction on full rated loads with performance that far exceeds Underwriters' Standards. Porcelain Receptacles No. 1736 and 1924 are pull-chain, three piece with shadeholder groove. For 3¼" or 4" box.

No. 1734 is our all-time favorite, with shadeholder groove. For 3¼" or 4" box. Complete with chain and cord.

No. 1634 Keyless receptacle with shadeholder groove. For 3¼" or 4" box.

Always Specify KNOX Wiring Devices

KNOX PORCELAIN CORPORATION
KNOXVILLE 1, TENNESSEE

Send for Literature

CATALOGS and BULLETINS

CONNECTORS — Comprehensive, up-to-date information on electrical connections for overhead lines in transmission and distribution is now available in one convenient publication, a 10-page manual issued by Burndy Corp., Norwalk, Conn., on connection techniques, connectors, and installation tooling.
Write in No. A151 on card, pg. 17

ELECTRIC HEATING — Electromode Division of Commercia lControls Corp., 570 Culver Rd., Rochester 3, N. Y., is now offering their complete line of electric heaters and heating systems for the home. Descriptions, specifications and illustrations are included for wall and portable heaters for large and small rooms, radiant panel heaters, baseboard heaters and radiant cable heat.
Write in No. A152 on card, pg. 17

ELECTRICAL EQUIPMENT — A new 12-page pictorial bulletin briefly describes manufacturing facilities and electrical products of Crouse-Hinds Co., Syracuse 1, N. Y. Emphasis is on the variety of equipment available in the four product lines; Condulet electrical equipment, floodlights, aviation lighting equipment, and traffic control.
Write in No. A153 on card, pg. 17

CONNECTOR BULLETINS — Six new bulletins have been released by Ilsco Corp., 4730 Madison Rd., Cincinnati, Ohio. They cover the Ilsco line of solderless connectors, special connectors, lugs, neutral bars, crimp lugs, and the Ilsco Lok-A-Blok. The bulletins include descriptive material, dimensions, and packaging data.
Write in No. A154 on card, pg. 17

WIRE PULLING LUBRICANT — Illustrated six-page folder showing the advantages of an improved Y-Er Eas wire pulling lubricant is available from Electro Compound Co., 4145 W. 150th St., Cleveland 11, Ohio.
Write in No. A155 on card, pg. 17

CATALOGS and BULLETINS

FLUORESCENT FIXTURES—The new Miller Sabre fluorescent fixture is illustrated in the Sabre catalog, page 13, published by The Miller Company, Meriden, Conn. This page points out application, construction details, and dimensional, illumination, and installation data.

Write in No. A156 on card, pg. 17

TROFFER CATALOG—A 36-page catalog, with complete information on their newly re-designed architectural troffers has been released by Smithcraft Lighting Division, Chelsea, Mass. Divided into sections for selection of lighting units, the catalog gives complete illustrations and data for 1 and 2 foot troffers in all types of ceiling construction. Also included in the catalog is information on ceiling lighting patterns, shielding designs, lighting techniques and applications.

Write in No. A157 on card, pg. 17

CONSTRUCTION ANCHORS — "Anchoring for Power and Communication Lines," a completely illustrated manual on improving line construction with better anchoring, has been published by the Advertising Dept., the A. B. Chance Co., Centralia, Mo. The 25-page booklet shows how to install the right anchor at the right place in the right way.

Write in No. A158 on card, pg. 17

SMALL WIRE STRAPS—Added to the one-hole Viking strap line are three new Midget straps for small wires. The #616 for fastening RX and UF 2/14, 2/12, and BX 2/14; the #416 for wires to ¼" OD; and #316 for wires of 3/16" and ¼". These galvanized straps, designed to take several sizes of wires; are featured in literature released by W. W. Cross & Co., Viking Cable and Fastening Devices, Greenville, R. I.

Write in No. A159 on card, pg. 17

RESIDENTIAL LIGHTING — A new catalog featuring their line of residential lighting fixtures has recently been issued by John C. Virden Co., 6103 Longfellow Ave., Cleveland 3, Ohio. The 48-page booklet is illustrated and in color. It pictures and describes incandescent and fluorescent fixtures for every room in the house and every design motif.

Write in No. A160 on card, pg. 17

NEW IDEAL "YELLOW 77"

WIRE PULLING COMPOUND

Creamy textured, yellow color, not messy, "good" smell.

- works best where the pulling is toughest—all wire sizes—including 500 MCM and larger.
- spreads out on wires in long runs—it won't quit halfway through!
- a little goes a long way.
- safe for hands and insulation, not damaged by freezing, won't dry out in the can.

EASILY APPLIED by hand, brush or cloth. Wipes off hands easily. It doesn't "wash-off" when pulling through water in conduits. Can be used to pull wires through steel, fiber or aluminum conduit. Clings around sharp bends and corners. Available in quart and gallon cans, 5-gallon pails and 55-gallon drums.

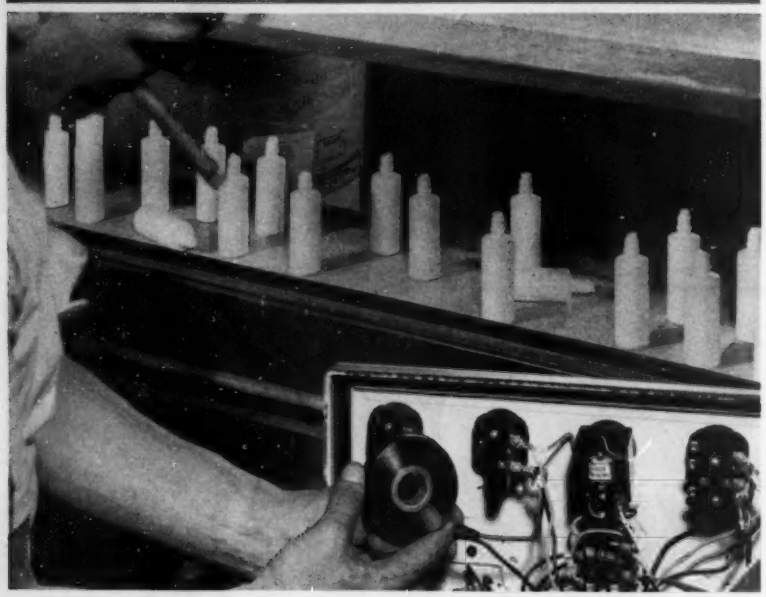
SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS

For complete details, write

IDEAL INDUSTRIES, Inc.
1017-H Park Avenue, Sycamore, Illinois
IN CANADA: Irving Smith, Ltd., Montreal

For more details on above items, use reply card on page 17

DEPENDABILITY



The "SCOTCH" Brand Electrical Tape No. 33 used to wrap splices on this control panel provides safe, dependable insulation at minimal cost. It conforms perfectly to small wires, applies easily in cramped areas, helps prevent costly production line breakdowns. When tape costs so little, can you afford less than the best?

BALANCED FORMULA IS THE SECRET: Whatever the task, you can depend on "SCOTCH" Brand Electrical Tape No. 33. Its perfect balance of physical properties provides the ultimate in holding, protecting and insulating all in one wrap. Strong, stretchy, it has the perfect "feel" to get jobs done faster, done right. Tough vinyl backing shrugs off moisture, sunlight, heat, cold and other adverse conditions. Pressure-sensitive adhesive adheres instantly, holds permanently, without creeping or end-lifting. Low power-factor provides excellent insulation . . . high electric strength, wet or dry. For every job you can put your confidence in "SCOTCH" Brand Electrical Tape No. 33.

FIRST and still the best

Minnesota Mining and Manufacturing Company
. . . where research is the key to tomorrow

"SCOTCH" is a Registered Trademark of 3M Co., St. Paul 6, Minn.

MODULAR LIGHTING—A twelve-page folder describing and illustrating their line of surfaced and recessed fluorescent modular fixtures is announced by Moe Light of Thomas Industries, Inc., Lighting Division, Brook & Broadway, Louisville, Ky. Complete coefficient of utilization and candlepower distribution tables are included for each set of fixtures.
Write in No. A161 on card, pg. 17

BUILT-IN HEATERS—Thermador Electrical Manufacturing Co., 5119 District Blvd., Los Angeles 22, Calif., has announced the availability of three new catalog sheets on their line of built-in electric heaters. The heaters described are their portable radiant-fan heater, electric ceiling heater, and baseboard electri cheater.
Write in No. A162 on card, pg. 17

CABLE SUPPORTING TRAYS — The Globe Co., 4000 South Princeton Ave., Chicago 9, Ill., has made available a new catalog on their line of cable supporting tray systems and accessories. The catalog contains information on design features, specifications, and installation.
Write in No. A163 on card, pg. 17

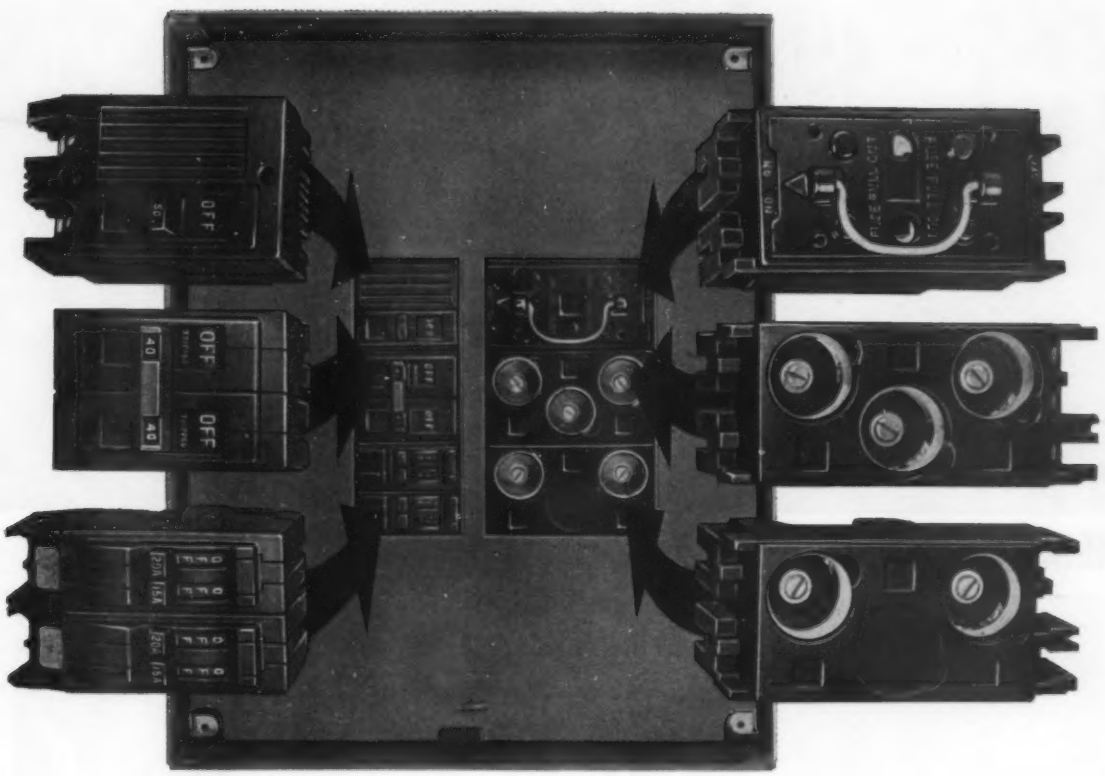
CONDUIT — With Rigid Polyvinyl Chloride Electrical Conduit gaining increasing popularity in the electrical field, Kraloy Plastic Pipe Co., Inc. offers a new, complete 20-page catalog. Included are comprehensive test results, specifications information, installation instruction, corrosion resistant charts, and other valuable data. Write Kraloy Plastic Pipe Co., Inc., Electrical Conduit Division, 402 West Central Avenue, Santa Ana, California.
Write in No. A164 on card, pg. 17

SWITCH & OUTLET BOXES AND ELECTRICAL FITTINGS — Catalogs B-960 and F-960 respectively feature the latest in switch and outlet boxes and electrical fittings. Completely illustrated, they contain over 100 pages of technical and informational data. A unique set of indexes in the fittings catalog make it the easiest reference catalog in its field. Available from the Electrical Fittings Corp., 37-50 57th St., Woodside 77, New York.
Write in No. A165 on card, pg. 17

LIGHTING FIXTURES — An extensive catalog containing bulletins on a wide variety of commercial, industrial, and residential lighting fixtures of both the incandescent and fluorescent types is now available from L & P Lighting, P.O. Box 157, Olive Branch, Miss. Illustrations, diagrams, and data charts are included, along with application suggestions.
Write in No. A166 on card, pg. 17

NEW BREAKER/FUSE PANEL

Plug in breakers and fuses,
mount surface or flush
all with one basic box



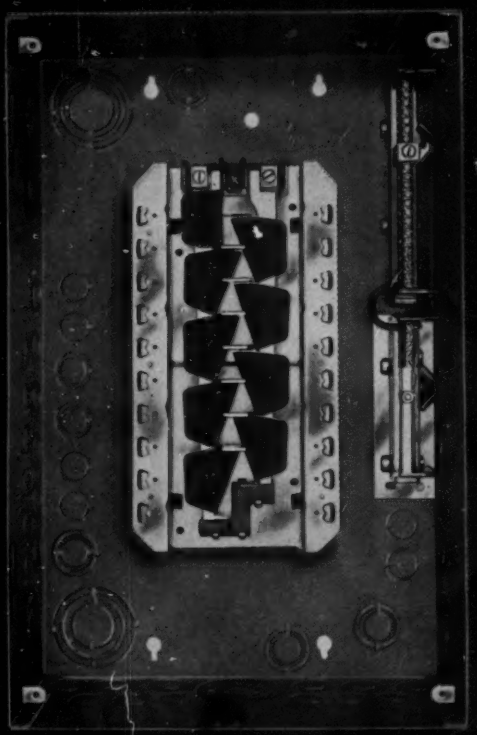
Now General Electric gives you the widest choice in service entrance equipment: "TWIN*" circuit breaker load centers... fuse puller panels and the new 4-in-1* Breaker/Fuse Panels.

*Trade Mark of General Electric Company.

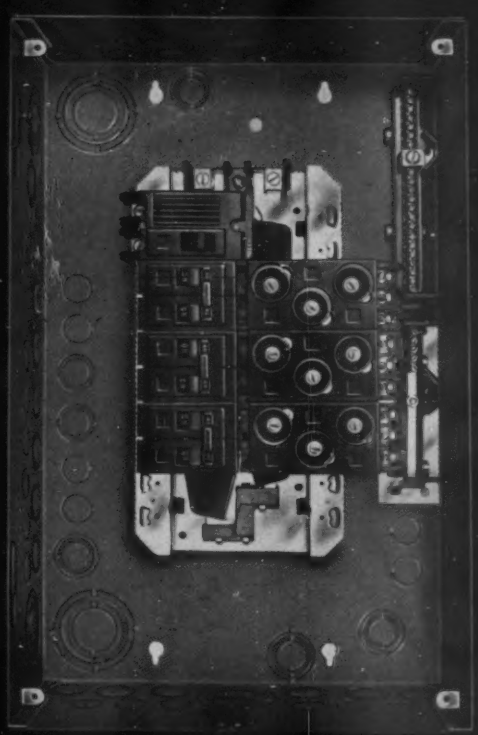
GENERAL ELECTRIC

For more details on above items, use reply card on page 17

SELECT ONE PANEL: PLUG IN

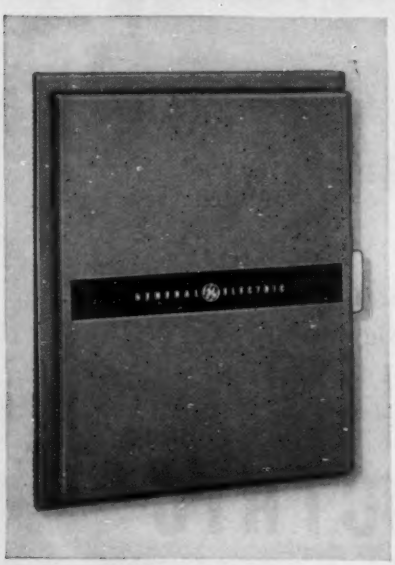


Typical Breaker/Fuse Panel . . . Cat. No. TP1612, shipped complete with box, front, interior; accepts *both* breakers and new G-E plug-in Fuse Blocks. Shown at right are three-ways to assemble this panel.



Mix Breakers and Fuses . . . Cat. No. TP1612 with back-fed 100-amp main breaker, three 2-pole TQL breakers, plus nine plug fuses—all in the same box. Only new G-E Breaker/Fuse Panels offer versatility like this!

COMBINATION ENCLOSURES - MOUNT EITHER SURFACE OR FLUSH

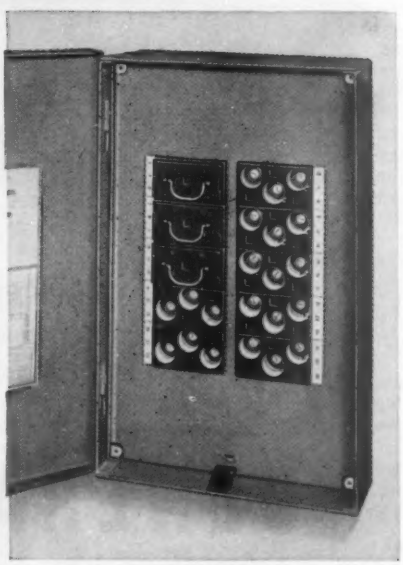


New Flush Frame Locks Around Box, Hides Rough Plaster, Assures Neat Job.

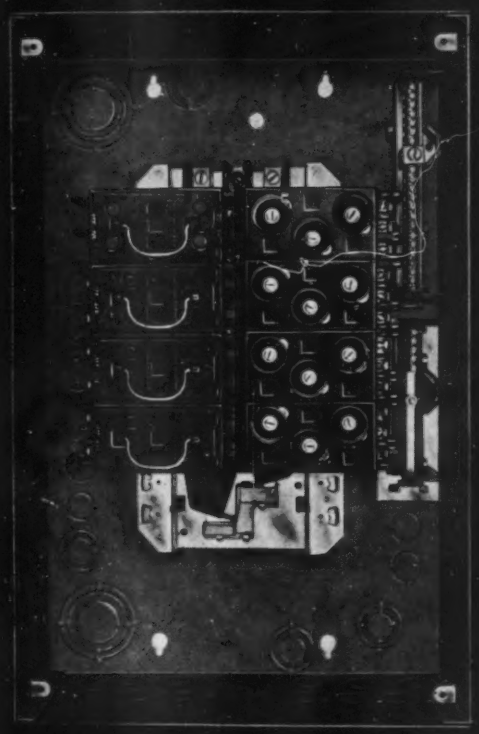
Here's dual mounting versatility: For flush installations, frame locks tight around box. Stud mounting ears automatically position box for ½-inch drywall — save time and labor . . . Nails quickly to studs.

For surface jobs, simply discard flush frame. It's as simple as that!

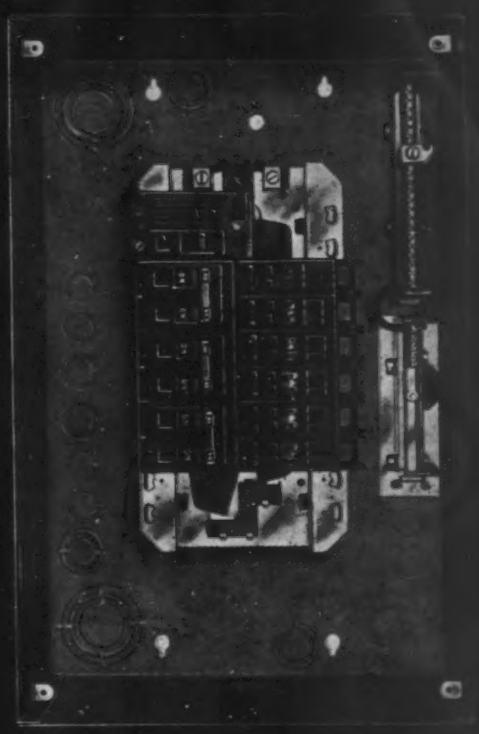
Complete Line 100, 125, 150, 200 amperes, 12 to 40 circuits. Main-lugs-only, split bus and main disconnect models cover full range of applications.



BREAKERS, FUSES...OR BOTH!



All Fusible . . . In the same TP1612 panel another choice is one 60-amp, three 30-amp pullers, plus 12 plug fuses. You plug in new G-E fuse blocks just like breakers — this is only one of many combinations possible.



All Breakers . . . Another way to wire the TP1612: plug in 100-amp breaker (connect line wires to breaker load terminals for backfed main), plus three 2-pole TQL's and 6 "TWIN" breakers, providing 12 lighting circuits.

A BOLD NEW APPROACH TO VERSATILITY...

Basic 4-in-1 Idea: With a single catalog number you order a combination flush-surface panel which accepts plug-in breakers, fuse blocks or both!

Wide Choice of Plug-in Units: Breaker/Fuse Panels accept any combination of these plug-in units . . .

- **30- and 60-amp fuse pullers (horsepower rated)**
- **2- and 3-circuit plug fuse blocks**
- **2-pole circuit breakers, 10 to 100 amperes**
- **Single-pole TQL and "TWIN" circuit breakers**

Bonus Installation Time-Savers: Snap-out front shield; stud mounting ears; reversible box and front; spring-mounted, snap-out interior; removable door; full sequence phasing. All panels are U/L listed and meet NEC non-interchangeability requirements. Available now from your General Electric distributor. Circuit Protective Devices Dept., General Electric Co., Plainville, Conn.

GENERAL ELECTRIC

For more details on above items, use reply card on page 17

Anyway you look at it Carol has the fastest growing line in the Industry

Take a look at Carol quality yourself . . . check its extra toughness . . . examine the foot-by-foot imprinting on Carol portable cords that show the gauge, number of conductors and types of insulation . . . color coded labels that instantly identify insulation . . . heft the durable see-through bags that make Carol cord sets such easy-to-sell merchandise . . . from any viewpoint you'll discover why Carol has the fastest growing, most salable line in the industry . . . why you should specify and sell Carol Cable Products.

Carol

CAROL CABLE COMPANY
PAWTUCKET, RHODE ISLAND

PORTABLE CORDS. POWER SUPPLY CABLES. ARC WELDING CABLES. FIXTURE WIRES. POWER SUPPLY CORDS. CORD SETS

INFORMATION CENTER

Help yourself to free literature and more details on any products mentioned in this issue.

Instead of writing a dozen different manufacturers for free literature and more information on products, equipment, or services, just insert on the cards below the appropriate key numbers of the items in which you are interested. These cards may be used to get information on products mentioned in the following departments (see Contents Page for page number):

Catalogs and Bulletins — New Electrical Products
New Utility Equipment — Advertisements

Be sure to print or write legibly your name and address—drop it in the nearest mail box and

ES pays the postage!

AUGUST, 1961

Send free information on these NEW PRODUCTS and/or services (fill in key numbers):

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Send this FREE LITERATURE (fill in key numbers):

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Company_____ Page_____ Company_____ Page_____
Company_____ Page_____ Company_____ Page_____

My Name _____ Position_____
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AUGUST, 1961

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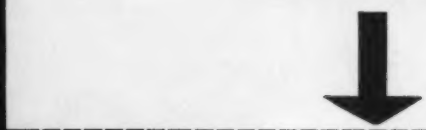
Send free information on these ADVERTISEMENTS:

Company_____ Page_____ Company_____ Page_____
Company_____ Page_____ Company_____ Page_____

My Name _____ Position_____
My Company's Name _____
Address (number and street) _____
City _____ Zone_____ State_____

These cards can help you get valuable information



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FIRST CLASS PERMIT NO. 582, SEC. 34.9, P. L. & R., ATLANTA, GA.

Electrical South
1760 PEACHTREE ROAD, N. W.
ATLANTA 9, GEORGIA

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 582, SEC. 34.9, P. L. & R., ATLANTA, GA.

Electrical South
1760 PEACHTREE ROAD, N. W.
ATLANTA 9, GEORGIA

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You may renew/enter my subscription to ELECTRICAL SOUTH for 3 years.

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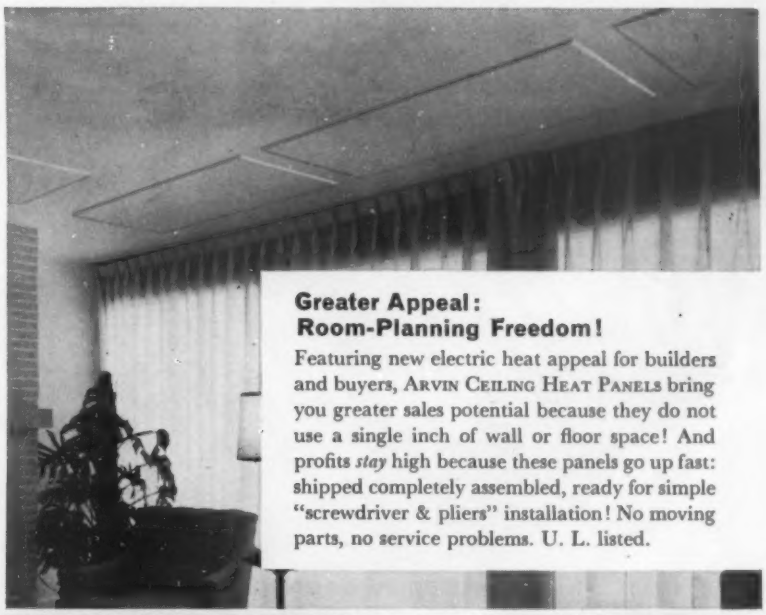
☐ **Enclosed find $3.00**
☐ **Send bill for $3.00**

Arvin Electric Invisa-Panels solve your space problems . . . and they're more profitable, too!

(Shown as Featured in a Better Homes & Gardens Idea Home)



Greater Appeal: Room-Planning Freedom!

Featuring new electric heat appeal for builders and buyers, ARVIN CEILING HEAT PANELS bring you greater sales potential because they do not use a single inch of wall or floor space! And profits *stay* high because these panels go up fast: shipped completely assembled, ready for simple "screwdriver & pliers" installation! No moving parts, no service problems. U. L. listed.

Sells On Size—1¾" Thin, 4½" Low! Pre-Wired: Fast, Easy Installation!

ARVIN ELECTRIC INVISA-BASEBOARD HEAT gives you the most *sellable* units available, slimmest and thinnest of all! Save time, keep profits up: units completely pre-wired for fast connection *from either end* to rough-in. High or low wattage, various lengths. Matching accessories.

ARVIN BUILT-IN WALL HEATERS

A complete line—seven fan-forced radiant models, from 3413 to 13,652 BTU capacities. Instant-heating elements. Each model features new-design rough-in box, quick-fastening clamps for new or old construction.

Write or call Arvin for facts and folders. No obligation.

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Electric Heat Division
ARVIN INDUSTRIES, INC. · COLUMBUS, INDIANA

A LEADING NAME IN ELECTRIC HEAT PRODUCTS FOR 28 YEARS

American Steel and Wire
Division of
United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Alabama, Southern Distributors
United States Steel Export Company, Distributors Abroad

Cut corners with flexible USS Armorlokt Cable

Remember your last conduit job . . . all the time and work needed to install junction boxes, not for new circuits but just so the cable could be pulled around corners? And the longer the pull, the more boxes you needed. USS Tiger Brand Armorlokt Cable could have been installed in approximately one-half the time and eliminated all that expensive pipe fitting and bending. ■ Armorlokt installs as easily as ordinary cable—yet it protects as well as rigid conduit, and sometimes even better because Armorlokt is flexible and "rolls with a punch." You can install it anywhere . . . up, down, across walls, buried in the ground, suspended in trays or on cable rings, indoors or outdoors. Armorlokt can be installed in long lengths, because its flexible construction permits easy and quick bending around corners, I-beams, or any other obstruction. And you can easily splice into Armorlokt Cable, anywhere along the entire length. ■ Armorlokt has a higher current-carrying capacity than the same size conductor in conduit because heat is quickly dissipated, not trapped inside. Corrosive atmospheres are no problem. Armorlokt is available with galvanized steel, stainless steel, aluminum or bronze armor. It's also available with an Ampyrol (PVC) jacket, in black or colors for easy identification. You can order Armorlokt with almost any kind of insulation, including varnished cambric, rubber, or asbestos up to four inches in diameter, rated 15,000 volts. ■ There's a standard USS Tiger Brand cable for every special job. For the complete story on Armorlokt Cable or any other type cable, call our nearest sales office or write American Steel and Wire, Dept. 1235, Rockefeller Building, Cleveland 13, Ohio.

USS, Armorlokt and Ampyrol are registered trademarks

Steel City Channel MOUNTS— FOR SURFACE

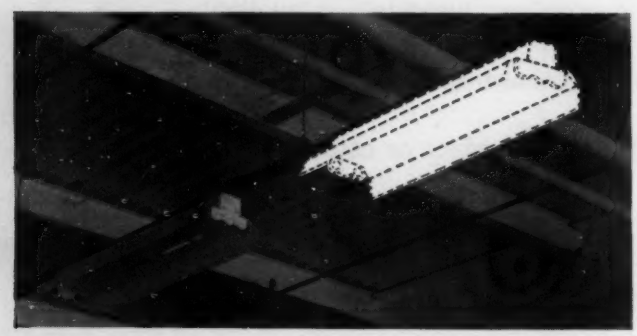
POWER TO SPARE—

A central wiring distribution channel with conductor capacity that exceeds requirements of any lighting layout and with power to spare for other uses. Here's a Channel that adapts to any interval of structural support—may be dropped to any level where it becomes a rigid platform for fixture attachment. Lighting fixtures may be spaced and fastened anywhere along the Channel System.

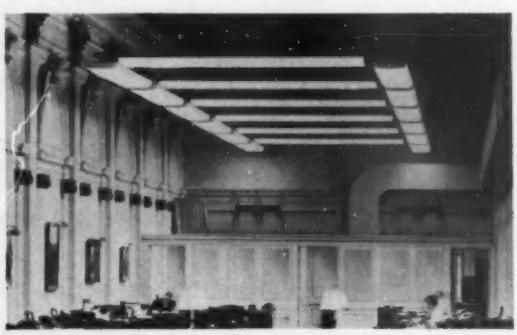
Branch lighting circuit conductors are completely enclosed in Channel from panel to fixture. This raceway carries full Underwriters' Laboratories, Inc. approval.

MONEY SAVING FEATURES . . .

● Eliminates cutting and threading of conduit ● Reduces number of hangers ● Uses existing boxes for wiring feeds ● Plug-in method reduces wiring costs ● The greater hanger spacing allows use of existing boxes with fewer intermediate hangers ● Pre-wiring of long lengths of channel at bench level ● Top mounted receptacles provide outlets for portable tools and machinery.



Fixtures may be added or relocated as required. To remove fixture, merely un-plug cord, open sliding fixture hangers and lower fixture. It's that easy.



Steel City Channel mounts, hangs and feeds the fluorescent fixtures in the lighting modernization of a bank office.

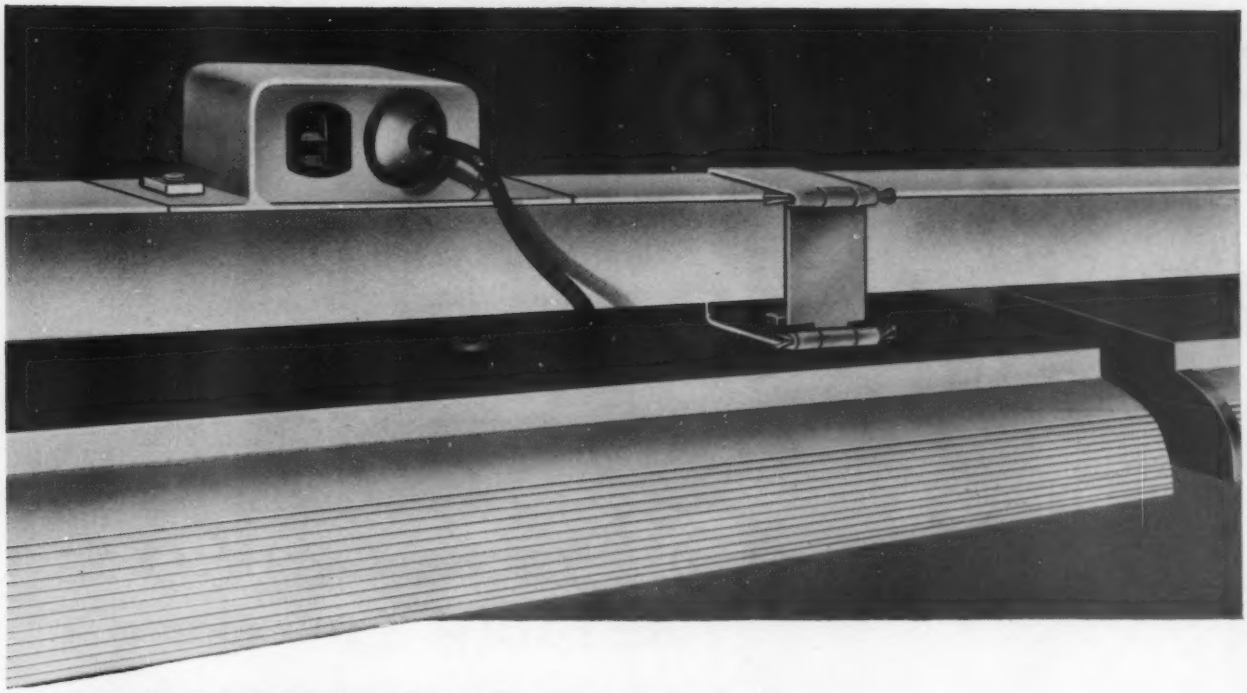
Easy removal of fixtures for ballast repair and cleaning reduces maintenance costs.

STEEL CITY ELECTRIC COMPANY

A subsidiary of American-Marietta Company

PITTSBURGH 33, PA.

For more details on above items, use reply card on page 17



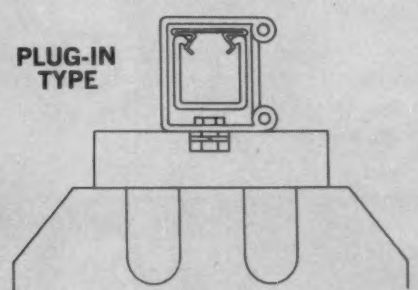
HANGS & FEEDS the fixtures

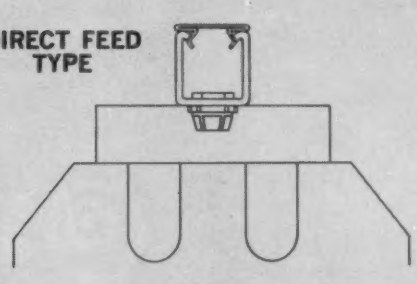
OR SUSPENDED LIGHTING

SURFACE RACEWAY SYSTEMS

LISTED BY UNDERWRITERS' LABORATORIES, INC.

FIXTURE ATTACHMENT METHODS





STEEL CITY CHANNELS

Channels of various depths and gauges, for use as surface raceway wiring systems or for fixture support only, are available as standard.

When used as a raceway, the Channel capacities are more than ample for every lighting requirement—up to ten No. 8 AWG conductors (National Electrical Code).

Steel City Channels and accessory fittings are protected by the GALV-KROM finish—an electrogalvanized finish PLUS added protection of zinc chromate. The GALV-KROM process imparts an attractive bronze lustre to the surface which does not require painting.

Steel City Electric Co.
Pittsburgh 33, Pa.

Please send me free booklet G-2.

Name_____

Company_____

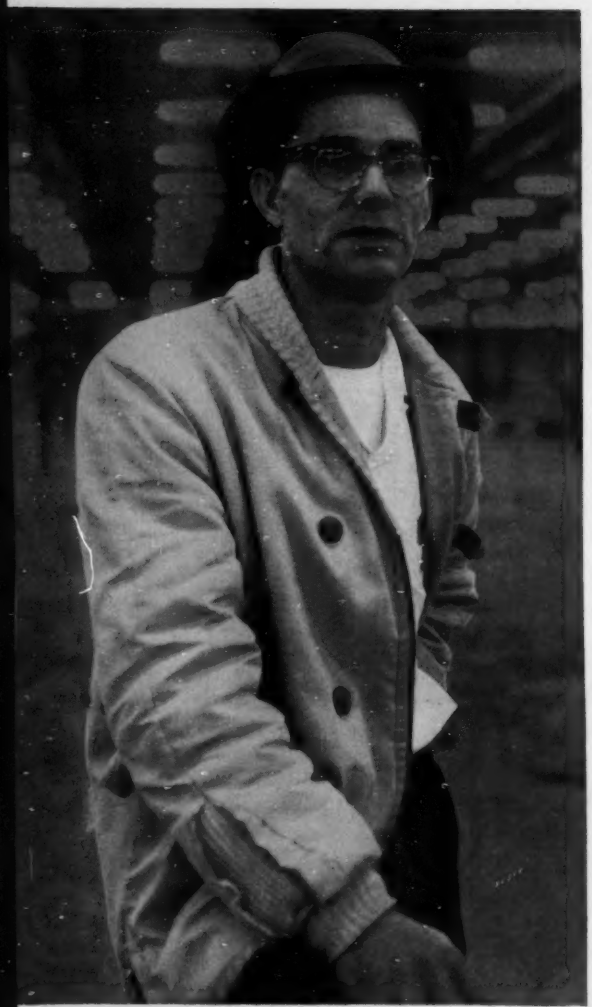
Address_____

City_____ Zone____ State_____

For more details on above items, use reply card on page 17

JOB-PROFIT TOOLING IDEAS

FROM GREENLEE



"On this warehouse job GREENLEE ONE-SHOT BENDERS cut bending time 80% for 1-1/2 to 3-1/2" diameter aluminum conduit,"

says ELMER BERINGHAUS,
field superintendent,
BECKER ELECTRIC COMPANY,
Cincinnati, Ohio

"Using Greenlee tools on this electrical contract enabled us to make neat, professional conduit installations in less time and with fewer couplings and fittings," reports Elmer Beringhaus, field superintendent for Becker Electric Company of Cincinnati.

"With our new Greenlee one-shot bender, a 90° bend in 3½" aluminum conduit takes about six minutes compared with 30 to 40 minutes using our previous method . . . a timesaving of 80% on every bend."

"We had to make nearly 300 bends in conduit ranging from 1½ to 3½" in diameter on this warehouse and service area job. A large percentage of the conduit was put in before the concrete floor was poured," Beringhaus stated. "Heavy, hard-to-move benders were out of the question in the kind of mud we had here. We selected a Greenlee bender because it's rugged, lightweight, and fast . . . and one man can move it and set it up. It has proved ideal for the type of on-the-site work we had on this contract."

See the facing page for pictures and stories of how Greenlee Job-Profit Tooling saved time and money on this $150,000 electrical contract.

"One man now does the work of two using the Greenlee No. 884 lightweight hydraulic one-shot bender for pipe and conduit. Our old benders required as many as 20 or 21 shots to make a 90° bend in 4" stock," Superintendent Beringhaus reports. "And two men were needed to align and level the conduit after each shot. Sometimes a complete bend had to be rejected because it wasn't smooth or level. This cost us time and money.

"With our new Greenlee one-shot, one man can make the setup and complete a 90° bend in aluminum pipe in about 1/5 the time formerly required — a substantial saving over our previous method." As the picture above shows, Becker powers its benders with a Greenlee No. 798 AC-SA hydraulic power pump. This pump is known throughout the industry for dependable, maintenance-free performance.

"The fast accurate way to make openings in junction boxes," states Beringhaus, "is with Greenlee knockout tools. We used a Greenlee No. 7310 hydraulic knockout punch driver and the punch sets shown here to make more than 200 conduit openings ranging from 1¼ to 4" in diameter. The fast cutting action of these units makes punching clean, uniform openings a snap."

The tools Becker Electric Company uses must be light, mobile, and fast-acting. They also must be able to take a real beating, as this job proved. Albert Osborn, Becker purchasing agent, reports that "there have been no repairs or maintenance on any Greenlee equipment used on this job."

Two new additions to the Greenlee line of Job-Profit Tooling

NEW lightweight (14 lb) hydraulic power pump

The Greenlee No. 1729 pump is a handy power source for hydraulic knockout punch drivers, rams, jacks, pullers, and similar tools with high-pressure, low-volume requirements. Two speeds . . . fast approach. High pressure to 10,000 psi.

NEW pipe holders for Greenlee benders

Greenlee No. 1803 pipe holders, designed for use with Greenlee benders, prevent "wows" and "dog legs" during segment and offset bending operations.

Pipe holders clamp quickly to each end of the pipe to keep it level and parallel with bender shoes and pipe supports. One size fits pipe from 1¼ to 4" in diameter.

GREENLEE JOB-PROFIT TOOLING includes over 100 different types and sizes of timesaving equipment designed to help electrical contractors streamline operations and control costs.

To learn how Greenlee tools assure extra efficiencies, better final results, *and more net profits,* see your Greenlee distributor . . . or write for Bulletin E-240A today.

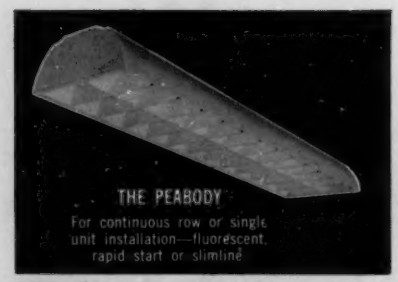
GREENLEE TOOL CO.
1956 Columbia Ave. Rockford, Illinois

TOOLS FOR CRAFTSMEN
GREENLEE ®

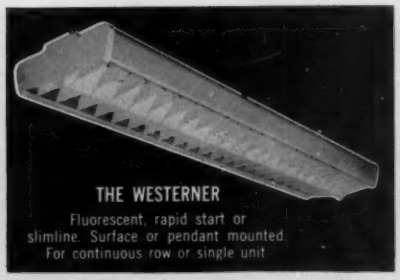
JOB-PROFIT TOOLING

. . . cost control for contractors

"LIGHT-UP" with L & P Lighting

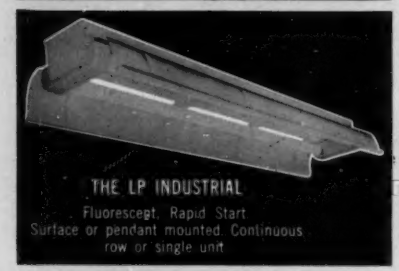


THE PEABODY
For continuous row or single unit installation—fluorescent, rapid start or slimline.

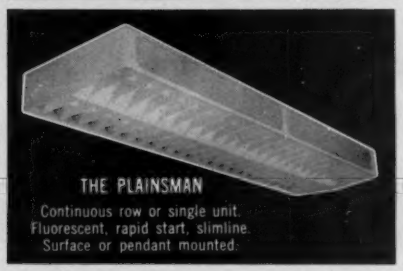


THE WESTERNER
Fluorescent, rapid start or slimline. Surface or pendant mounted. For continuous row or single unit.

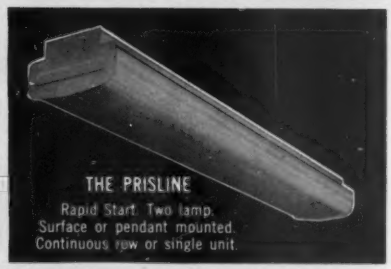
THE EXPLORER
Enclosed commercial, 2 and 4-lamp, surface or pendant mounted.



THE LP INDUSTRIAL
Fluorescent. Rapid Start. Surface or pendant mounted. Continuous row or single unit.

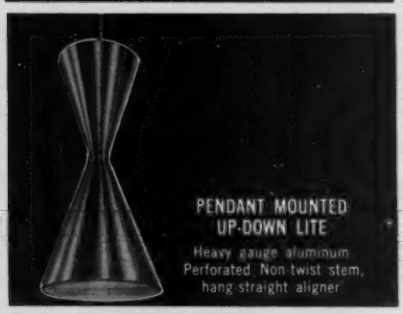


THE PLAINSMAN
Continuous row or single unit. Fluorescent, rapid start, slimline. Surface or pendant mounted.



THE PRISLINE
Rapid Start. Two lamp. Surface or pendant mounted. Continuous row or single unit.

THE FALCON LOUVERED
Slimline, Rapid Start. 1 lamp or 2. Surface or pendant mounted. Continuous row or single unit.



PENDANT MOUNTED UP-DOWN LITE
Heavy gauge aluminum. Perforated. Non-twist stem, hang straight aligner.

SURFACE OR SEMI-RECESSED SQUARE
Vandal-proof, Tamper-proof, Weather-Resistant.

CONCENTRIC RINGS
Seamlessly-butt welded steel. Heavy gauge aluminum canopy. Aluminum non-reflecting baffle.

DOME LITE
Heavy gauge spun aluminum. Available pendant, surface or recessed.

BRACKET LITE
Cast aluminum. Moisture and vapor resistant. White opal globe.

Here are only a few of the quality fixtures in L & P's complete line of fluorescents and incandescents—everything from open and enclosed commercials, industrials and strips, corridor lights and troffers, to illuminated ceilings, concentric rings, bracket and dome lights, rounds and squares. For beauty, efficiency and economy, order L&P fixtures.

For complete catalog and price lists, write

L&P LIGHTING

Olive Branch, Mississippi

L & P Distributors Serve Their Customers

L & P fluorescent and incandescent fixtures are distributed by wholesale dealers only. This is done not only in fairness to the dealers themselves, but to their customers as well. L & P distributors know that every L & P sale will be credited to one of their members. The ultimate L & P customer, in turn, knows that he can depend on a specific L & P distributor to make sure he gets the traditional L & P "service after the sale" in his area.

Distributors are regularly called upon by L & P agents. They look to these agents to keep them fully informed of the very latest developments in lighting fixtures, so that they, on their part, can advise their customers on the best possible fixtures to meet their own particular needs. This is personalized service—a product of L & P's manufacturer-agent-distributor-customer partnership.

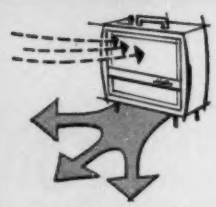
LIGHT & POWER UTILITIES CORP. L&P

L & P LIGHTING

OLIVE BRANCH, MISS.

1035 FIRESTONE BLVD. • MEMPHIS, TENN.

Another Example of Martin Engineering Leadership... The Martin Counter Flow Filtaire Portable Electric Room Heater.



HOW COUNTER FLOW PRINCIPLE WORKS

Has revolutionary filter and counter flow heat principle which pulls air through filter at top, cleans, passes over heating unit and out through bottom to blanket area to be heated; fully automatic, two speed, push button controls; pilot light; sealed bearing motor; high input; safety cut off; fully portable; 5 year guarantee against element burn out; two 2400 watt heating elements which can be used separately or together for full 4800 watt capacity. Can be used as fan in summer.

This latest addition to the Martin line of portable room heaters does infinitely more than just heat. It takes the dust-laden, germ-laden air in a room, pulls it through a Permachem treated air filter to remove airborne dust and germs, passes this purified air over the powerful Martin heating element, then spreads this filtered warmth AT FLOOR LEVEL over the entire area to be heated. For the full story on this Martin Filtaire and the entire Martin Leadership Line of electric heat products, write today.

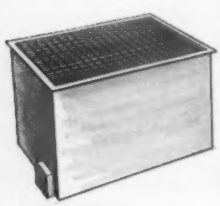
"TWIN-FIN" ELECTRIC BASEBOARDS

ELECTRIC WALL HEATERS

ELECTRIC PORTABLE HEATERS

ELECTRIC BATH HEATERS

ELECTRIC CEILING CABLE



ELECTRIC FLOOR FURNACES

MARTIN

STAMPING & STOVE COMPANY

HUNTSVILLE, ALABAMA

AMERICA'S MOST COMPLETE HEATING LINE

KNOW YOUR SYMBOLS

This symbol stands for bus duct

This symbol stands for QUALITY

XL Bus Duct by BullDog

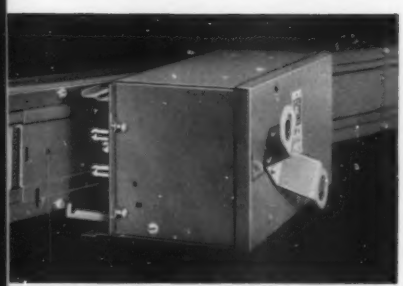
Makes light work of installation four ways!

1 *Keyed ends* of plated aluminum bars align automatically, join as fast as sections can be handled.

2 *Single integral bolt* spins tight quickly to secure bars under a ton of pressure. Captive screws join casings together.

3 *New* HANGFAST *Adapter* bolts to suspension rod fast ...duct with standard hanger is instantly hooked and secured.

4 *Lightweight*, rigidly-made 10-foot sections require only *half* as many hangers as ordinary duct.



PLUG-IN SAFETY—Self-supporting XL Safety Plug hooks to duct, leaving workman's hands free to complete electrical plug-in with utmost ease and safety.

BullDog, the creator of plug-in bus duct, has for years assisted industrial plant operations by providing high performance, efficiency, flexibility and dependability in power distribution. Then BullDog went one step further . . . developed XL BUStribution® Duct to make installation and handling easier than ever before, as shown above. At the same time, BullDog incorporated foolproof dead-front safety as well as other features ensuring that workmen plug in for power the safe way *only!*

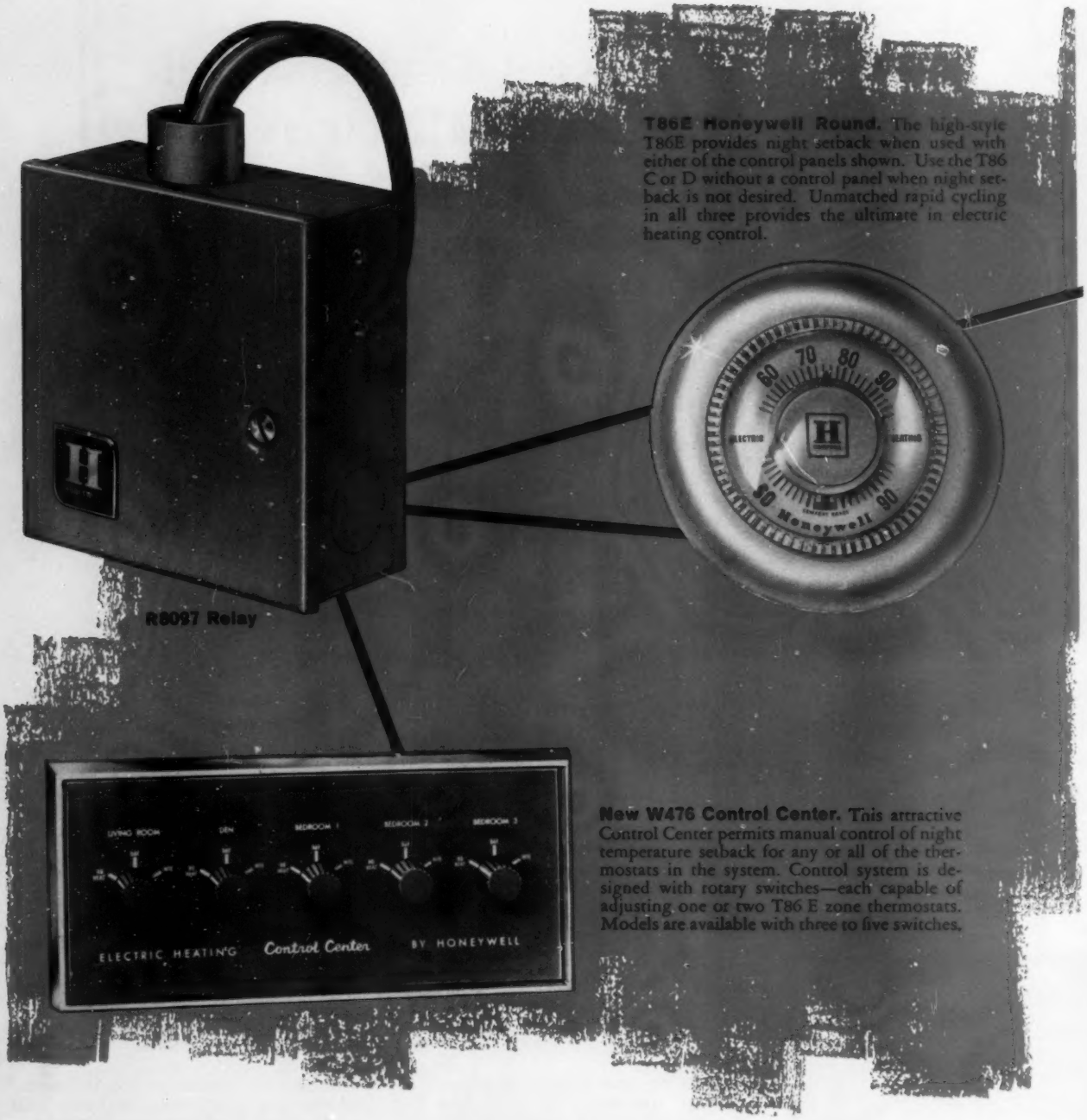
Ask your BullDog representative to show you all these XL Duct installation and safety advantages. He can also provide complete information about BullDog BD plug-in duct, LO-X® plug-in duct and LO-X feeder duct.

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Mich. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N.Y.

Contact the I-T-E Office in your locality for additional product information and service.

I-T-E CIRCUIT BREAKER COMPANY

BULLDOG ELECTRIC PRODUCTS DIVISION



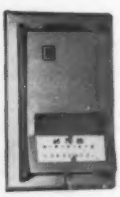
T86E Honeywell Round. The high-style T86E provides night setback when used with either of the control panels shown. Use the T86 C or D without a control panel when night setback is not desired. Unmatched rapid cycling in all three provides the ultimate in electric heating control.

New W476 Control Center. This attractive Control Center permits manual control of night temperature setback for any or all of the thermostats in the system. Control system is designed with rotary switches—each capable of adjusting one or two T86 E zone thermostats. Models are available with three to five switches.

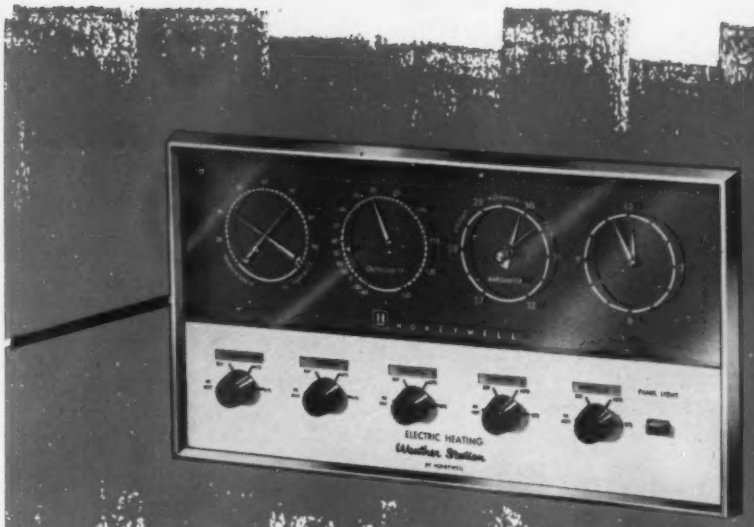
T832 *Day-Nite Round.* Unique thermostat features handy manual setback, automatic heat pick-up—day and night.

T87 *Heating-Cooling Thermostat.* With new finish, larger numerals. Same streamlined styling as the T86 Round.

T88B *Thermostat.* High-style economy thermostat with selectable heat anticipation and mercury switch operation.



T83A *Thermostat.* For budget-minded customers, a two-wire, low-voltage thermostat, with snap acting contacts.



The W489 Honeywell Weather Station.* Now your customers can control indoor comfort and check outside weather conditions at a single central location. New low-voltage system lets homemakers pre-set day and nighttime temperatures for completely automatic or remote manual control with up to ten zone thermostats. Check indoor humidity and both outdoor and indoor temperatures at a glance.

Bring out the best in Electric Heating with

HONEYWELL LOW VOLT CONTROLS!

Versatile R8097 Relay makes possible the widest range of control combinations ever offered the electric heating industry.

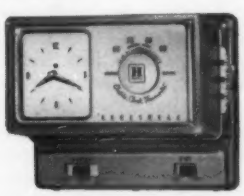
This completely flexible relay works perfectly with Honeywell low voltage thermostats or central control panels, giving your customers a choice of the ultimate in electric heating controls. These deluxe controls are engineered and designed especially for electric heating and they give you every assurance of top performance, top profits. What's more, you get immediate customer acceptance because of Honeywell's long established reputation for quality.

Total flexibility is yours when you feature the Honeywell line! In addition to the relay coupling with the top of the line, the R8097 is also adaptable to each of the wide selection of standard thermostats shown below. For further information on these—or on the finest in line voltage thermostats for electric heating—call your nearest Honeywell office. Or, write Honeywell, Dept. ES-8-81, Minneapolis 8, Minn. *Sales and service offices in all principal cities of the world.*

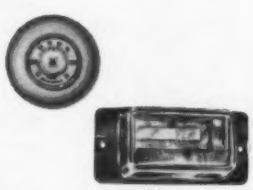
Honeywell

H HONEYWELL *First in Control* SINCE 1885

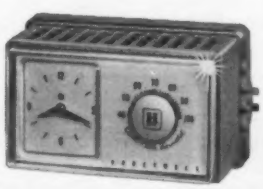
*Trademark



T861 *Heating-Cooling Electric Clock Thermostat.* A deluxe control for year-round automatic day-night comfort.



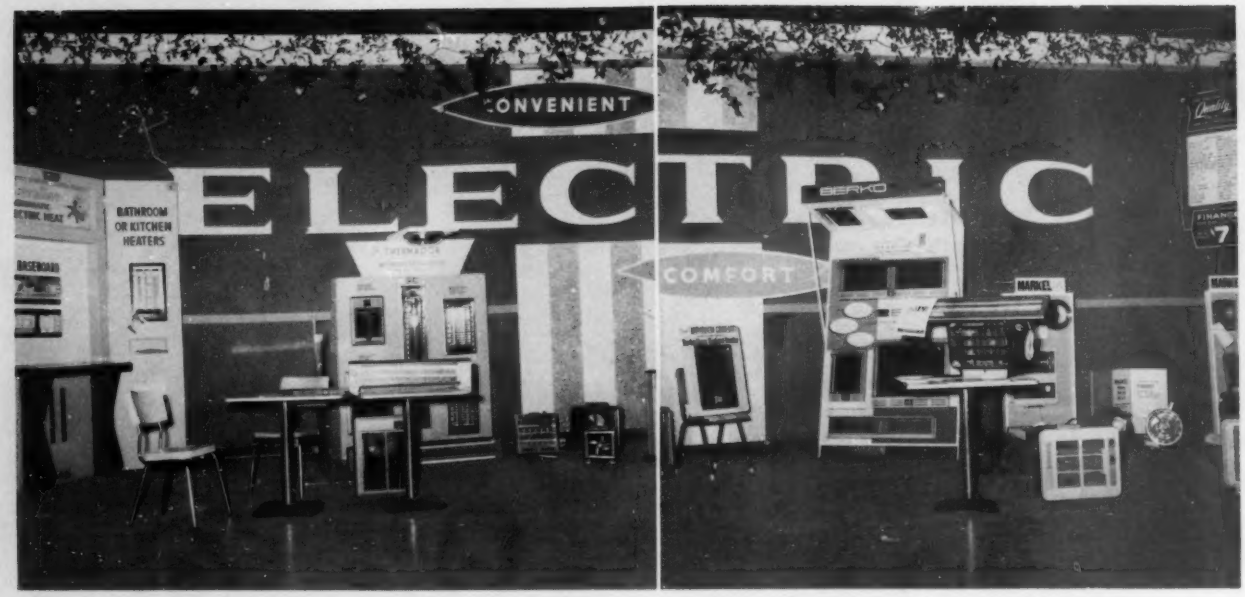
Indoor-Outdoor *System.* T846A outdoors senses temperatures; T855A indoors compensates for changes.



T852 *Electric Clock Thermostat.* A deluxe thermostat providing completely automatic day and night heating comfort.

T870 *Heating-Cooling Thermostat.* A deluxe family that satisfies the complete range of heating-cooling needs.

For more details on above items, use reply card on page 17



The FAEC Tampa Chapter used this exhibit at the 1961 Florida State Fair to introduce to the public . . .

Contractors' organization creates

With the public as the greatest benefactor, the program insures

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electrical Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

By Stanley H. Gaylord, President, Tampa Chapter, Florida Association of Electrical Contractors.

◆ Electrical contractors often have been passed up by the parade of progress.

Through their own lack of foresight and aggressiveness they have found themselves to be followers instead of leaders in the sale of new products and services.

We all know how they fared, for example, in the appliance boom of the late '40's, and we in Tampa, fortunately, are aware of how it could happen again in the next big breakthrough in electrical heating.

More than 600,000 electric comfort heating installations were made last year, mainly in the South. By 1965 we can expect this market to be measured in terms of $200,000,000. By 1970, at least 6,000,000 homes will be heated by electricity.

The potential business of wiring and installing the ceiling cable, the wall convectors, the baseboard heaters, underfloor circuits, and heat pumps is enormous.

Yet, if we are not alert to our next big opportunity, if we are not vigorous, ambitious, and responsible in handling it, someone else will do the job, or it won't be done.

Many of us remember in heating how coal replaced wood, how anthracite replaced coal, how gas and oil replaced anthracite. The pendulum of time now, at last, has swung in our direction.

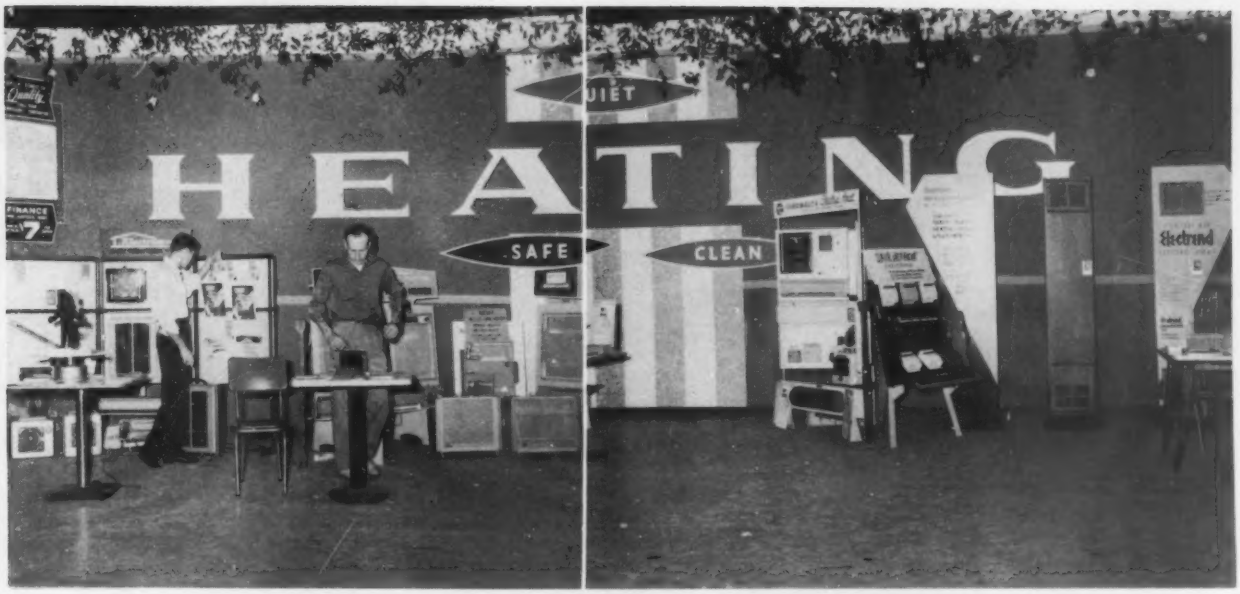
The Tampa Chapter of the Florida Association of Electrical Contractors is determined to hold it for awhile by satisfactorily selling and servicing one of the most practical, efficient, economical conveniences ever developed.

We have already begun the task in a planned, orderly, and effective way. We are enthusiastic about our program, and we recommend it to any others interested in the electrical industry as a means of leading rather than following the advancement of modern electrical products and applications.

We are preparing now as an organization, because it could not be done so well individually, to educate ourselves and our personnel in the sales technique of electric heat. We are adding to our basic knowledge of wiring and electrical installations the physics and characteristics of heat.

Since proper insulation is essential to successful electric heating, we are familiarizing ourselves with insulating techniques. We are learning to calculate heat losses.

We are looking into different types of electric heating equipment; radiant and convection heaters, unit heaters, baseboard, ceiling cable, and others. We are



. . . its electric heating certification program emphasizing the superior quality work by certified contractors.

certified electric heating program

that contractors will put in dependable and ethical installations

learning the advantages and disadvantages of electric heat, and how to reply to competitive disclaimers.

Members of our Tampa Chapter are doing all this so they will be able to go out and talk intelligently and honestly about electric heating, and to sell and install it satisfactorily.

In fairness to the public, so that our customers will know they are receiving dependable, ethical installations in electrical heating, we are working under an education program the completion of which will entitle a contractor to advertise and solicit business with a valid certification as a "Certified Electric Heating Contractor."

With this assurance to the public, the certified contractor will also receive the assistance of the FAEC Tampa Chapter through the sales program of its certification system.

Contractors who complete the educational course by passing the required examination are certified

(Continued on page 118)

Those directing the certification school for Tampa contractors were Stanley H. Gaylord, standing, president of the FAEC Tampa Chapter, and, left to right, "Professor" James Yost, Tampa Electric; Joe Sierra, Tampa FAEC secretary, and Dick Williers, vice-president.

Junction boxes were concealed in the ceiling beams. Heating cable is installed in the floor and ceiling.

Heating a large contemporary home

Modern architectural features complicate system design and installation

In spite of large expanses of glass, the house is comfortable inside.

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

By Clyde W. Unglesbee, President, Olney Electric Co., Inc., Olney, Md.

◆Wiring a home of contemporary design poses new problems for the contractor.

Large expanses of glass, sloping roofs, beamed ceilings, and an often remote and inaccessible location of the home in the country test the ingenuity and skill of the electrical contractor designing an installation for light and power.

We met an added challenge

when we were awarded the job of planning and installing electric heating in a 17-room residence of contemporary design in the country located on a knoll overlooking a lake.

Planned as a weekend and vacation house for the present, and a future retreat after retirement, this comfortable modern residence with its enormous square footage, its diamond-patterned floor plan foundation built on a concrete slab, and glass-enclosed pavilions typifies the new factors in construction an electrical contractor has to meet to obtain adequate heat distribution.

Due to design and location of this home, insulation was a key factor, as it is in any electric heating installation, with regard to the amount, type, and economy of the heating operation.

Radiant heating cable was installed in the floors and ceilings. Construction consisted of placing four inches of gravel directly on the earth, then a layer of polyethylene, two inches of rigid insulation, and finally four inches of concrete on top.

Over this heating cables were placed topped with two inches of topping concrete. The floors were finished in asphalt tile.

Rigid insulation was used on both horizontal and vertical perimeters. Outside walls were insulated with four inches of fiberglass, and reflector type aluminum paper insulation was placed between studs and plasterboard.

Ceilings combined six-inch fiberglass insulation and aluminum paper on both sides of the rafters. Cable was stapled directly to the rock lath and plastered over. Doors and windows were thoroughly weatherstripped.

Radiant heating cable in the floor and ceiling permits easy control and quick response for the impromptu and brief weekend visits of household members. In most rooms there is more than one heating cable. The living room has seven heating cables, with each heating cable on a separate circuit and protected by its own circuit breaker controlled from a subpanel.

Relays come off between the main panel and subpanels. One of our problems was how to control all cables without having a huge main distribution panel. This was met by installing a series of subpanels.

The temperature control system was adapted to the intermittent

(Continued on page 117)

Index emphasizes improved insulation - of high importance in electric heating

◆A heat index, a new method to lower heating costs through improved insulation, will allow more lower and middle income families to purchase FHA-insured new and better homes. Insulation is especially important in electrically heated homes.

The formula has been developed by the National Association of Home Builders and the National Mineral Wool Association, and is based on the Federal Housing Administration's policy of encouraging builders to use materials and equipment which will reduce the home owner's monthly expense of maintenance.

Full details and technical explanations of the new development — a simple heating index — were contained in an article by Milton W. Smithman, NAHB technical director, in the January 1961 issue of the *Journal of Homebuilding*, official NAHB magazine.

By means of a simple heating index it is now possible to illustrate how additional insulation effects changes in the FHA's estimate of prospective monthly housing expense and the rating of the buyer's ability to pay.

Commenting on the heating index, W. Beverley Mason, Jr., FHA assistant commissioner for technical standards, said: "FHA has followed with great interest the work of the NAHB industry committee in its development of the idea of a thermal index for use in determining more efficient and economical use of house insulation."

Mr. Mason added: "We have found the index and its proposed application to be technically correct, and believe it will be most helpful to builders and FHA insuring office personnel in deciding on insulation specifications which will give the home buyer the most for his money."

The heating index is the key to simplified figuring of the amount by which better insulation can reduce monthly housing expense. It combines in one figure the variables of heating degree days, cost of combustion fuel, and the efficiency of the heating equipment.

Essentially, this is the way the heating index works:

Let us compare two 1,200 square foot houses in a city where 6,000 heating degree days prevail and fuel costs $.10 per 100,000 BTU. Heating equipment with 70 per cent efficiency rating is used in both houses. House "A" has insulation just meeting FHA Minimum Property Standards (MPS) while house "B" has enough additional insulation to achieve ceiling and wall "U" values of .07 and .09 respectively.

It is now possible to show, by a simple computation, that the monthly expense for house "B" will be $3.43 less than in the case of house "A".

This means that, all other things being equal, FHA will rate a "buyer's ability to pay" for house "B" on a par with the buyer of house "A" even though he has $294 less annual income than the buyer of house "A". At the same time, house "B" is rated the better home.

For the technical reader, the heating index is:

$$\frac{DD \times C}{Eff.}$$

where DD = degree days; C = fuel costs in dollars per 100,000 BTU; and Eff. = efficiency of the heating equipment.

For example, where the number of degree days equals 5,475, the fuel cost is $.10 per 100,000 BTU, and the efficiency of the heating equipment is 75 per cent, substitution in the above formula would give:

$$\frac{5{,}475 \times \$.10}{0.75} = 730$$

thus giving a heating index value of 730.

When the builder's purpose is to reach more prospective buyers, installing additional ceiling and wall insulation would affect financing, as in this example for a 1,000 square foot house with a typical heating index of 730:

The original selling price of the house is $14,300, and with additional insulation the selling price

(Continued on page 117)

Lamps provide the only pool-side heat.

On each side of the pool are two rows of 50 bullet-shaped fixtures.

Space heating with infrared lamps

This type of equipment is especially suitable for high ceilinged areas

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electrical Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ Infrared lamps, while not used as frequently for electric comfort space heating as other types of equipment, appear to hold promise as a space heating means for numerous special applications.

A number of applications of this type of equipment have been made in industrial plants for spot heating in high ceilinged industrial buildings, shipping platforms, etc., but a more sophisticated use of this equipment has appeared in several recently announced installations — one of these an indoor swimming pool and the other a large gymnasium.

The pleasures of swimming and basking in "summer sunshine" day or night all year are being enjoyed in enclosed pools.

Banks of heat and sun lamps provide bathers with the benefits of warmth, light, and suntans.

General Electric illuminating engineers, who designed the lighting-heating-tanning aspects of several such projects, see the technique as having nationwide potential not only for privately owned pools, but especially for pools at motels, cabana clubs, country clubs, and elsewhere.

The new method of adapting swimming pools for full-time use was designed by Herold Bradley, a Pittsburgh, Pa., architect.

In one installation, to protect bathers from cold and inclement weather, Mr. Bradley enclosed the pool with a 35- by 67-foot building. The structure has two side walls and one end wall of insulated glass, and the other end of concrete block. A pitched roof, supported by steel beams, extends from a height of 9.5 feet at the sides to 16 feet over the center of the pool.

A glass-enclosed breezeway, off which are dressing rooms, a small kitchen, and bar, shields bathers as they move between the house and the pool.

Over the concrete lounging apron on either side of the pool are two rows of 50 deep, bullet-shaped fixtures. Every eighth fixture contains a sunlamp, while the other seven house 250-watt infrared lamps. Lamps are operated on ten circuits to provide flexible use.

The heat lamps warm bathers immediately, since they produce radiant energy (45 watts per square foot) which heats as the sun. In an early test the radiation increased body comfort the equivalent of changing air temperature

Rectangular infrared fixtures mounted on the ceiling provide heat and light for players and spectators in the gym.

around the pool from 52 to 90 degrees in less than three minutes.

Enclosing of outdoor pools has not been practical in the past because of the necessity to construct a well-insulated structure and to heat the entire space, Mr. Bradley pointed out. By using infrared lamps the heating problem is greatly reduced, since the lamps need to be turned on only during the period the pool area is in use. As the water is heated by conventional methods, heat lamps are located only over areas where bathers congregate on the pool's apron.

In the warm months of the year glass panels forming the walls will slide open to provide six screened exits, which will admit fresh air and permit ready access to the sunshine on the terrace outside. Heat and sun lamps will be replaced by colored floodlights, permitting the pool area to be enjoyed in the summertime during inclement weather conditions which otherwise might prevent its use.

In another application, the question of whether or not electric infrared heating is a practical and economical method of heating high-bay institutional, commercial, and industrial buildings is being answered on the campus of Greenville College, Greenville, Ill.

During the past winter an electric infrared installation in the college's new gymnasium supplied both heat and light for all functions held in the new building. It is the first installation of its type in the country and Greenville College officials, faculty, and students unanimously attest to its overwhelming success.

The installation was jointly promoted by Luminator, Inc., Chicago, manufacturers of the infrared fixtures; Guarantee Electrical Co. St. Louis, Mo., who handled the engineering and installation; and the Illinois Power Co., Greenville's local utility company.

The Luminator infrared fixtures are equipped with T3 tubular quartz infrared lamps. These lamps convert about 87 per cent of their input wattage into radiant heat. Burning at 4,100 F, they also give six to eight lumens of light per watt when burned at full voltage.

The infrared rays generated by the lamps and reflected by the Luminator fixtures act like the rays of the sun. They do not heat the air. Rather, the energy from the lamps heats only persons or objects upon which the lamps' rays fall.

Thus when Glenn Richardson, executive vice-president of Greenville College, announced to spectators at dedication ceremonies: "You are now absorbing electric 'sunshine' from radiant electric heating units in the ceiling," his analogy was quite proper.

(Continued on page 116)

Baseboard units heat apartments

Multi-story all-electric cooperative uses 230 kw of baseboard heat

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

By Jim Igou, Cavalier Corp., Chattanooga, Tenn.

◆ Overlooking Clearwater Bay in Clearwater, Fla., are the Belvedere Apartments—one of the first, if not the first, all-electric cooperatives built in this section of the country.

Even though the all-electric cooperative apartment was a new concept, the owner experienced no difficulty in selling the apartments. The Belvedere was completed and turned over to the manager in March, 1959, and full occupancy was in effect during the heating season of 1959-1960.

The partial electric apartment, in the Clearwater area, has been accepted practice for some years with the electric kitchen, electric water heater, and electric air conditioner as standard equipment. But electric heat—well, that was another matter entirely.

It represented a hurdle that required many man-hours of careful consideration between the electric utility representatives, consulting engineers, and builders before a final solution was reached.

It wasn't an easy job to convince the builder that an *all-electric* apartment could be sold when other types of apartments were being sold and could be sold with little buyer resistance.

The all-electric approach to apartment building was a bold approach and a little radical, but Wes Charlow and Bob Brunner of the Florida Power Corp., Clearwater Div., had the facts, figures, and persuasion. Subsequently, a decision was reached to use electric baseboard heat in the Belvedere Apartments.

The building is seven stories tall with 24 individual apartments and a recreation clubroom for apartment owners. Each apartment is equipped with an electric built-in kitchen, electric water heaters, garbage disposals, and dishwashers.

With lighting and other electrical appliances, each individual apartment met the requirements necessary for a Bronze Medallion designation. The entire building was awarded a Medallion Plaque.

Each individual apartment is separately metered and the circuit breaker panel, meter box, and meter are housed in the electrical utility room. A commercial meter to supply hallway and exterior lighting, laundry, elevators, and the clubroom is located in the electrical utility room, along with the main switch.

The total connected load for the building is in the vicinity of 900 kw operating off a 1,600-ampere main switch served by three No. 350 MCM type RH entrance cables and one No. 4/0.

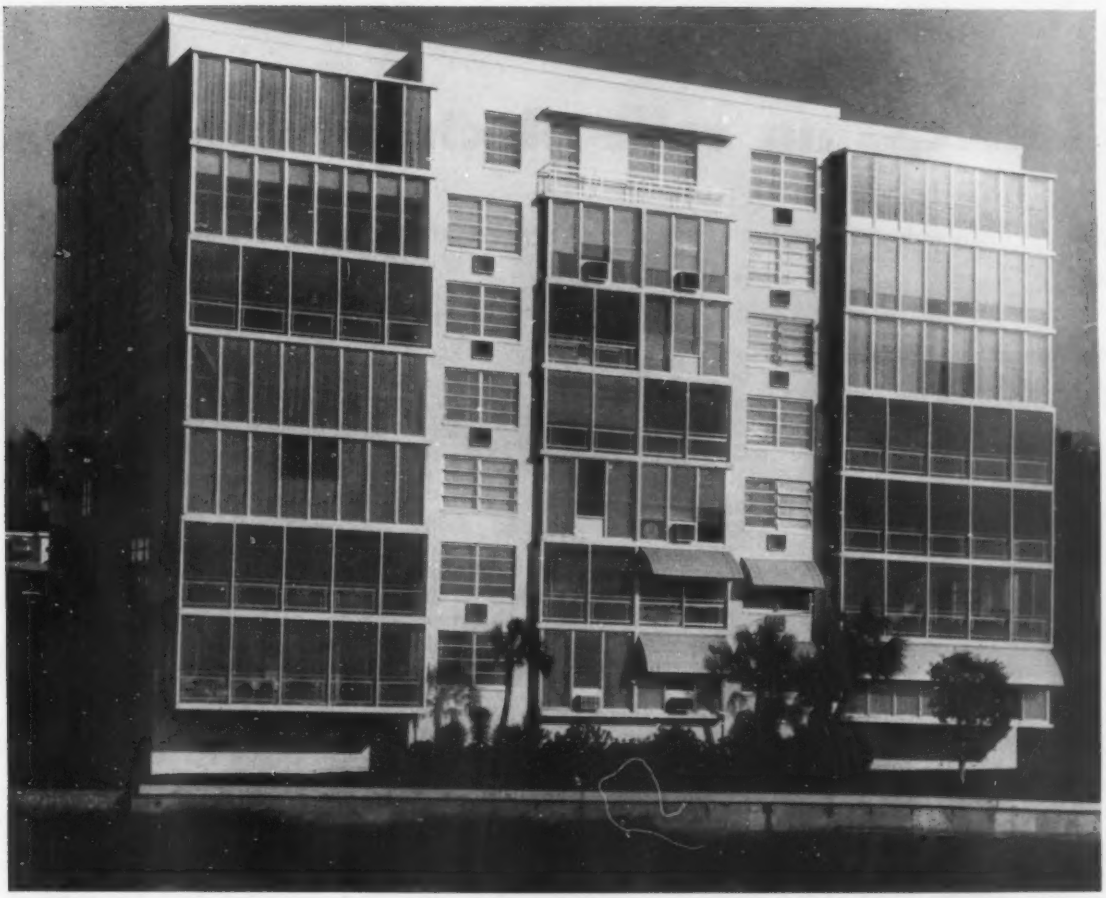
Of the total load, 230 kw is electric baseboard heat, making this one of the largest baseboard heating jobs in the state of Florida. For flexibility, 48-inch and 32-inch heating sections were used, and

(Continued on page 116)

Table 1—Operating costs, 1959-1960

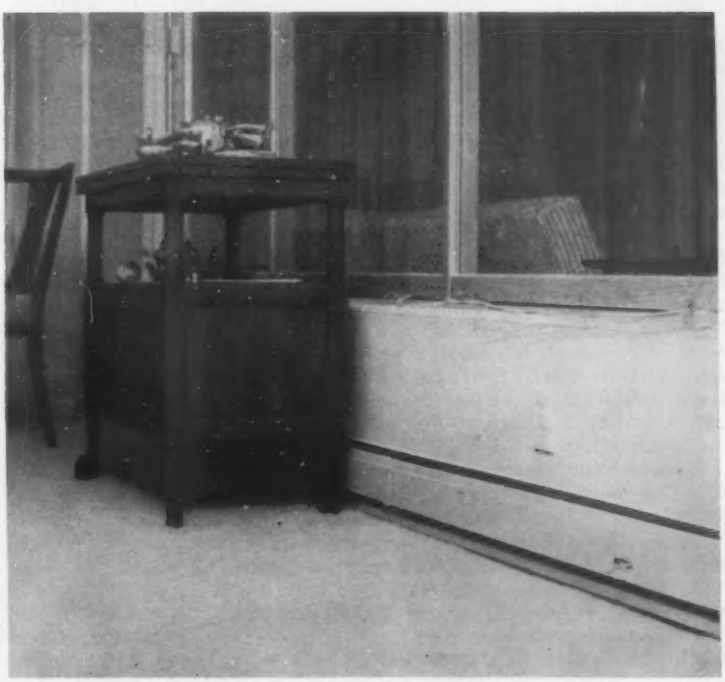
Degree days = 628 Normal degree days = 450

Apartments	Square feet	Installed capacity in kw	Cost of operation Estimated	Actual	Cost per square foot
1st floor	848	11.7	$ 90	$ 99.00	11.7¢
2nd floor	765	6.6	65	59.00	7.7
2nd floor	848	8.7	70	59.00	6.9
3rd floor	848	8.7	70	38.80	4.6
4th floor	854	8.2	70	52.16	6.1
5th floor	848	8.7	70	53.84	6.3
6th floor	848	8.2	70	70.76	8.3
7th floor	1,530	11.9	100	132.48	8.6
7th floor	1,624	13.8	90	83.36	5.1



Careful placement of heating sections plus owner instruction counteracted the effects of large glass areas.

FPC's Bob Brunner used facts, figures, and persuasion to install electric heat.



Operating costs for the first winter of operation met with the approval of owners, as did the comfort and cleanliness of the baseboard units.

Canvassing sells electric heat pump

Firm emphasizes benefits of a central system and canvasses only homes

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

By Ross Holman, Field Editor, Nashville, Tenn.

◆ Every weekday, shortly after breakfast, A. B. Crisler takes off in his car to canvass for another buyer of a home comfort system—a heat pump.

If he leads a prospect to the dotted line, the M. P. Kimbro Electric Service at Madison, Tenn., installs another central heating and air conditioning job, with both the heating and cooling operations done electrically.

Middle Tennessee has the distinction of pioneering electric heat as one of the best ways yet of counteracting winter temperatures. Mr. Kimbro long ago quit trying the room-at-a-time method of chasing chills out of the atmosphere or modifying the summer heat to a cooling satisfaction.

He offers to install the total home comfort job in one package and let the same central heat pump warm or cool every room in the house according to need. He won't even offer to sell or install a single room air conditioner. He says the competition to sell these room-by-room units is so strong he can't make enough money at it.

Unlike some electrical contractors, he doesn't solicit jobs from speculative builders of subdivision homes, although many of these builders are installing central home comfort units. Since these subdivision developers are trying to build homes as cheaply as possible, Mr. Kimbro finds it difficult to make as profitable a deal with them as he can with a bona-fide homeowner.

Since World War II many homes in the area have been built without either electric heat or air conditioning, although these homes are better adapted than most pre-war houses for the installation of these conveniences.

Some of the owners are looking for improvements that will bring increased enjoyment. They measure these improvements from the standpoint of family enjoyment and not to make money, as would be the case with a speculative builder.

However, there are certain classes of homes that Mr. Crisler will not canvass. The majority of houses built before World War II were built in the days when heat was drawn mostly from the wood pile or coal bin. The cooling was done with a palm leaf fan. Many such houses have high ceilings, the doors and windows may not fit well, and, generally speaking, they have neither modern insulation nor other heat confining facilities.

Insulation required

Most houses built since the war were insulated in construction. Many of them have storm windows and doors. Then again, the rooms are mostly smaller and have lower ceilings. These are the kind of residences that Mr. Kimbro canvasses. If the homes do not already have insulation and storm windows and doors at the start, Mr. Kimbro doesn't recommend installing his central units unless they are added before he takes the job. Otherwise he feels that the dissatisfaction that would arise would ruin his business.

Among central units he has installed in this area are 100 GE Weathertron heat pumps. "In four months I have had only one complaint from these 100 installations that required a service call," he said. "I've had a few calls where the user didn't fully understand all the details of use.

"In that case I told him what button to push, what adjustment to make, or maybe just to change filters. Usually after such instruction I heard no other complaint. One of our important jobs in this connection, of course, is educating the customer in the proper use of his plant.

"We tell the homeowner that if he wants to air condition and heat his whole house he doesn't save any money by doing the job one room at a time," explained Mr. Kimbro. "These total installations are becoming more popular in our area.

"This year many speculative builders recommend that every home costing $20,000 or more be centrally heated and air conditioned. They say such a home will sell or resell at a price to more than justify the cost of including these facilities."

In stressing the advantages of central home comfort units, Kimbro Electric has been so successful in selling these installations that it has become a major portion of its construction operations. One of its four crews is delegated exclusively to these jobs. In addition to the GE Weathertron, the firm sells about the same number each of Carrier and York heat pumps.

"I carry all three of these lines," says Mr. Kimbro, "because when I sell a central home comfort job I may find it difficult to get all the supplies needed from one line. With three brands on which to draw I rarely ever fail to have all the essential installation equipment in one of them."

Specialty selling

Mr. Kimbro says the main reason his volume of sales in central units is so good is his livewire field seller, A. B. Crisler, who spends his time glorifying their advantages.

Mr. Crisler not only promotes these units but, where the prospect shows a spark of interest, he can engineer the entire job and give him an estimate on the spot while his interest is warm.

installations

that are insulated

He is prepared to show him or direct him to already installed units of satisfied users. The customer satisfaction among more and more users is another important impetus for increasing sales.

One selling punch that Mr. Crisler uses to create sales is comparable figures on the use of electric heat from a competitive standpoint with other fuels. Mr. Kimbro has reports showing that some of his users who have 2,000 square feet of floor space and seven rooms are using only $125 worth of electricity a year to both heat and air condition their homes. In other words, Mr. Kimbro finds all the cost figures to be on his side and such facts can do more to break down sales resistance than most other advantages put together.

Other jobs

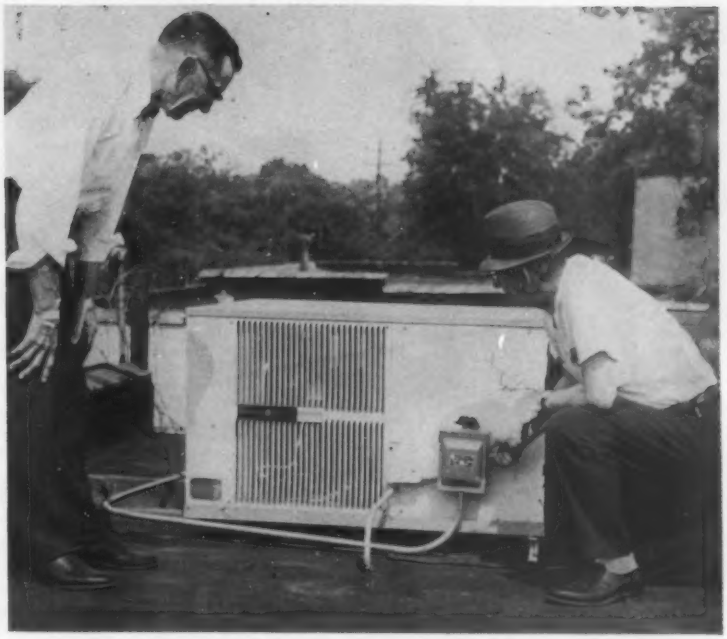
In addition to its home installations, Kimbro Electric has sold its jobs to many churches, schools, and business houses. For example, it got the contract for the Church of Christ at La Vergne, 20 miles away; the new jail building in Centerville, 50 miles away; the Church of Christ at Dickson, 50 miles away; and the Seventh-Day Adventist office building in Madison.

In each home and non-home job Mr. Kimbro puts a one-year guarantee providing free service calls for that period of time. As already indicated, he avoids many service calls by thoroughly instructing the customer in the use of his plant and, in many cases, by being able to tell h'm by phone how to adjust his trouble.

"I have learned a lot by experience," says Mr. Kimbro. "I have not only learned how to do the kind of job that forestalls most complaints, but how to analyze the need when the customer complains."

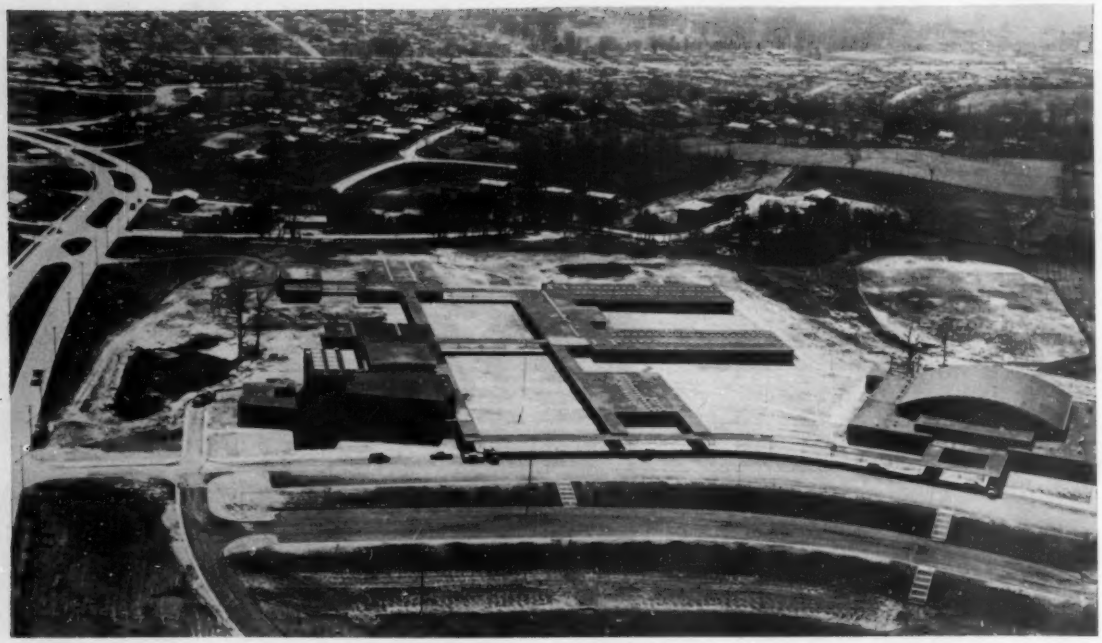
While Mr. Kimbro shies away from the old style houses that were

(Continued on page 74)



Mr. Kimbro (right) is explaining a heat pump to one of his prospects.

Mr. Crisler (right) talks with Mr. Kimbro before taking off on a canvassing trip. Mr. Crisler can make an on-the-spot job estimate.



Only an aerial view can show the buildings of the new $2,250,000 all-electric Science Hill High School.

Large new high school uses

Several types of equipment provide heat

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers ✓
- Consulting Engineers ✓

By Warner Ogden, Field Editor, Knoxville, Tenn.

◆ The largest all-electric school in the Tennessee Valley region and one of the largest in the nation is the new Science Hill High School at Johnson City, Tenn.

It is also the 33rd all-electric school in the region and the number is growing.

Eight buildings, with 35 classrooms and a large gymnasium—in all totaling more than 125,000 square feet of space—are heated electrically. Jones Electric Co., 727 Walnut St., Johnson City, was the electrical contractor.

J. G. Bacon, manager of the company, states some facts about the project. "Several different types of heating were used in the Science Hill High School job. Some were unit ventilators, some ceiling type unit heaters, and some baseboard units. There are big blower type units that have electric coils and are more on the principle of hot air systems.

"Classrooms have built-in blower type units, with cabinets and heaters all arranged together as one unit. We did all the wiring for the installations. There is some wall type heating. We furnished all the wall type heaters, unit heaters, and all the baseboard heaters.

"In the classrooms, these wall, shelving type units were furnished and installed by S. B. White Co., and wired by us.

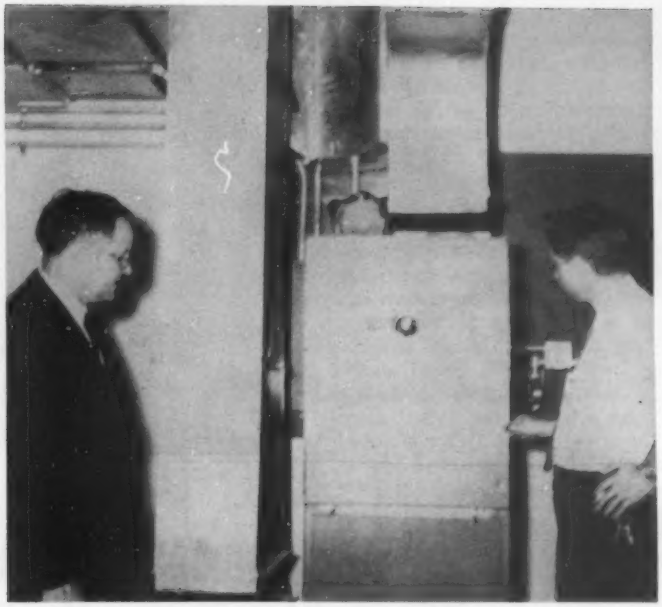
"Problems? No, we did not run across any particular problems on the job. Everything was pretty well laid out, which is important on a job like that. Aluminum conduit in various sizes and aluminum wire—from size No. 2 on up—were used. It was the first job in Johnson City in which such wire and conduit were used together.

"Plans and specifications had to be followed closely. Everything was laid out before the start, and units came assembled. A 5,000-ampere service feeds the entire school. The heating load is 2,600 kva, water heating, 652 kva; kitchen, 210 kva; lighting and miscellaneous, 747 kva.

"Besides the heating, there are other electrical features. All fluorescent lighting is operated off 277 volts, instead of the usual 120 volts. The system in the school is 480-volt, four-wire.

"Each building has its own bank of transformers, to reduce the voltage to 120 volts for all convenience outlets and miscellaneous needs. The water heating, etc., is on 480 volts, and three-phase water heaters were installed. The large electric heating units are operated on 480 volts.

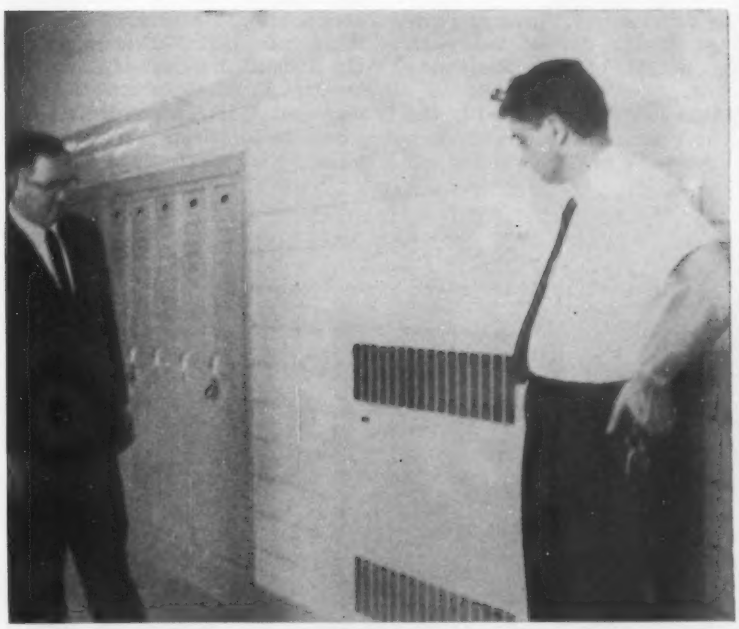
Classrooms have attractive installations of built-in blower type heating units.



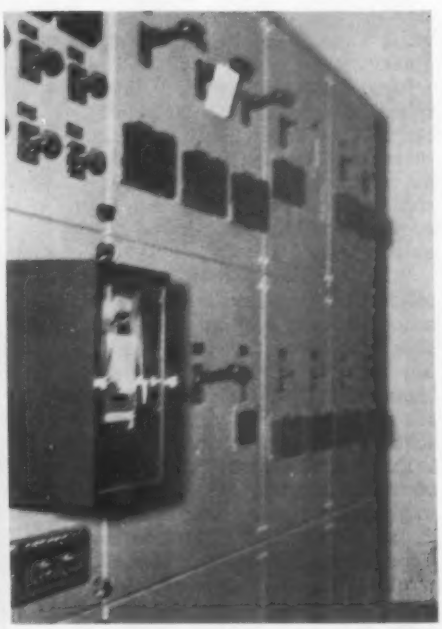
Principal George Greenwell, left, and electrical contractor J. G. Bacon, right, examine a unit resembling a hot air system.

electric heating

for the eight buildings of this well-designed all-electric project



Wall units were used in the hallways. The entire installation went smoothly, and various sizes of aluminum wire and conduit were employed.



Heat control may be programmed through this convenient distribution power center.

"The school has a complete intercom system and a music system tied in with that. The auditorium has one of the most modern stage lighting systems in the U. S. All lights can be controlled from a big dimmer board.

"The large gymnasium — also electrically heated—has electrically operated folding bleachers. There is also an electrically operated folding partition down the center, so that the gymnasium can be cut in half for practice games. All the basketball goals can be raised and lowered electrically. There are eight goals, although only two are used for actual play.

"The school is set up for a closed circuit television system. Under the gymnasium is a modern rifle range for the ROTC students—electrically heated and lighted, of course. The gymnasium has modern press boxes and an amplifying system. There is even a large electric kitchen.

"I believe such electrical schools are the coming thing. Just about everything in this area now installs electrical heat and other electrical equipment. The biggest saving is in the installation.

"Electric heat is better because you have individual temperature control. One person may be cold natured and another warm natured, but you can control the temperatures. Small units, such as those installed in the school, have individual thermostats."

Fred S. Vreeland, of Vreeland & Montgomery, engineers, Knoxville, Tenn., was the electrical engineer on the job.

Mr. Vreeland endorses electric space heating in schools. In a letter to T. W. Newberry, TVA Research and Demonstration Branch, he wrote: "We have made several studies for new schools and have reviewed operational data on many existing schools.

"It is our . . . opinion that when all factors are considered, electric school heating is the most desirable type of heating as well as being just as economical as other type systems. I feel that we will see an ever increasing number of schools heated electrically."

Educators and others who know of the all-electric schools have also given favorable comments. Supt. B. E. Hobgood of Murfreesboro, Tenn., city schools, for instance, wrote that in all the new buildings, " . . . we are highly pleased with the new heating processes being used."

(Continued on page 115)

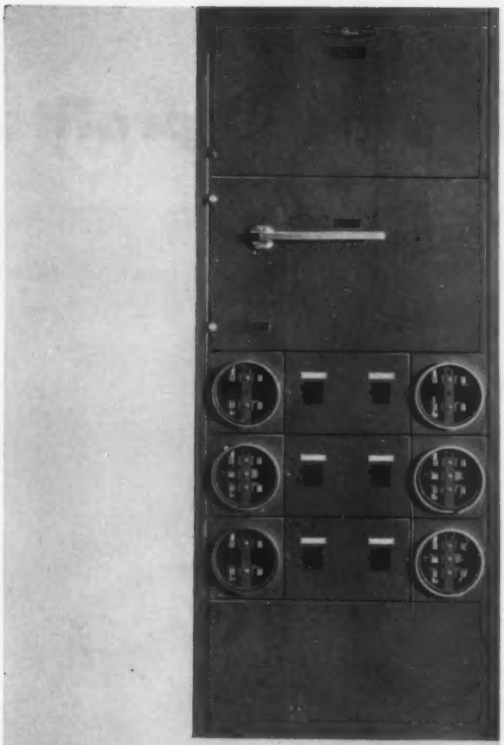
Demonstration shows rapid warmup of electric baseboard heating units

◆ When the new Boonslick Apartments in St. Louis, Mo., were opened recently, featuring all-electric service including baseboard type electric heat, sales personnel of Union Electric Company (the St. Louis electric utility) and Emerson Electric, manufacturer of the heating equipment, teamed up to present an effective demonstration of the value of baseboard type electric heat.

The demonstration was presented to visitors during the open house period of the apartment opening.

In the upper photo, with the electric baseboard heaters off, dry ice vaporizing on the window sill shows how cold air enters the room from the window area and slips down to floor level. Ten seconds after the baseboard heater is turned on, as shown in the lower photo, the dry ice vapor is warmed and pressed back against the window by a curtain of rising warm air.

Those in the photo are E. K. Handlan (back to camera), sales manager for electric heat and air conditioning, Emerson Electric, and left to right, William and Donald Radcliff, builders of the apartments; Eugene Johanson, sales manager, Union Electric Co.; and Howard Hunsicker, sales supervisor, Union Electric Co.



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For more details on above items, use reply card on page 17

Baseboard units bring good profits

Improved products from manufacturers and lower rates for electricity have given contractors a new impetus to push baseboard heating sales

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

By C. Thomas, Field Editor, El Paso, Texas.

◆ "The sale and installation in an average residence gives me a far greater net profit than I make on the entire wiring job," says Al Guevara, owner of Friendly Electric Service, El Paso, Texas.

The installations he mentioned were baseboard electric heating units, and he was more than enthused over their success.

Mr. Guevara is quick to admit that electrical contractors, like himself, have for years been underselling their customers on the use of electricity for heating.

"Manufacturers lagged behind. Their heating units were outdated. Electric rates were out of proportion, compared to available fuels. That's all been changed."

Obviously, manufacturers had to make the first move. That is, they had to design and place on the market units that were trim, easily installed, and efficient. Like big business, they had to become competitive.

With modern heating units on the market, El Paso Electric Company was induced to announce: "Effective September 15, 1960, the El Paso Electric Company modified its residential and commercial service rates to provide an electric space heating rate for customers heating their homes and businesses electrically."

This space heating rate is applicable for any type of space heating equipment which is permanently installed, in regular use, and with a total connected load of at least five kw. In addition, the entire installation is subject to the approval of the El Paso Electric Co., and it is the customer's responsibility to notify the utility of such installations.

"Don't get misled," Mr. Guevara continued. "Homeowners, especially the distaff side, don't have to be sold on heating electrically. They welcome the opportunity."

But let's examine his sales pitch in presenting electric baseboard heating. The safety feature is, no doubt, first. There are no fumes, and no burning of oxygen out of the air. The electric baseboard units, thermostatically controlled, eliminate the wasting of fuel.

There is no fire hazard. Should a window drape be blown in front of a unit, or a child toss his clothes over one, the unit automatically cuts off.

Regardless of these features customers praise the cleanliness more than anything else. There is no more opening doors or windows to air a place out.

The majority of prospects, however still consider heating electrically a luxury.

"But the cost is not exorbitant," Mr. Guevara points out. "Let's take an average three-bedroom home. In our climate, and with our modified electric rate, it's going to cost no more than $90 to heat the home for the six-month season, November through April. That's providing the house is insulated. Forget those that are not."

There is no point in trying to break the operating cost down to a monthly basis. It can't be done with any degree of accuracy or fairness.

A local privately owned two-story maternity hospital was literally forced into resistance heating. Unable to procure a permit to vent their gas heaters because of the city's zoning and code regulations, they called in Friendly Electric Service.

Al Guevara recommended electric baseboard heating throughout. Twenty-four units were installed, with a thermostat for each room.

Al Guevara, of Friendly Electric Service, El Paso, feels contractors have undersold electric heating.

"The doctor is building a new hospital," said Mr. Guevara, bringing out the plans. "The hospital will be much larger than the old, with more rooms, more beds, and with three delivery rooms instead of one. It will also be heated and cooled by electricity. We will transfer the electric baseboard heating units to the new hospital, add to them, and augment them with heat pumps."

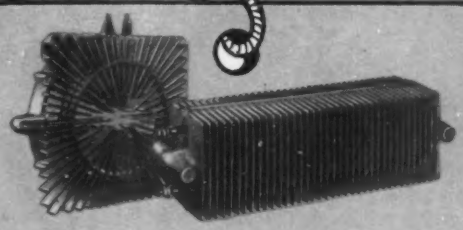
Many of Mr. Guevara's baseboard installations began by first doing only a bedroom. With the customer happy with the results, another room or two was converted over, and then the entire house.

"There can be nothing but satisfaction. The low operating cost, with no maintenance cost or worry, is bound to result in happy users."

It has been checked and verified that homeowners cannot buy these units for do-it-yourself installation. Neither can they buy

(Continued on page 115)

Compare and YOU will Install



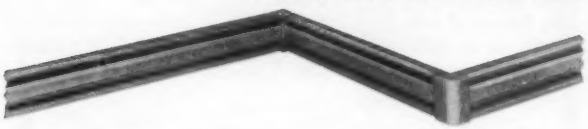
Comparison from the standpoint of safety engineering will show there's no unit in electric heating to match Electromode's exclusive All-Aluminum Safety Grid. Only Electromode has this feature, tested and time-proven to be the safest on the market. It's the grid that boosted Electromode to leadership in the electric heating field. There are no exposed hot wires. No glowing coils. All heating elements are permanently embedded deep inside a cast aluminum sheathing, assuring positive protection against fire, shock or burn.

®Electromode

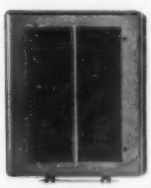
flameless ELECTRIC HEAT

Comparison from the standpoint of performance will show that Electromode's Aluminum Grid has many other advantages, too. Aluminum is rust resisting, non-corrosive. It is one of the best known metals for conducting and radiating heat. Yet its surface temperatures in operation remain amazingly low. Trouble-free Electromode grids are guaranteed five years against burnout and practically eliminate the need for service calls. More and more contractors are installing Electromode because comparison has shown it is the cleanest, safest and most efficient flameless electric heat on the market today. Continue to install Electromode and build up your dividends in mounting customer satisfaction.

ELECTROMODE LOW-LEVEL BASEBOARD HEATERS



Offer the last word in modern heating for any home. Electromode perimeter heating provides the comfort of radiant warmth along outer walls, under windows and across floors. Come in varying lengths. Customized, matching fittings permit a pleasing baseboard effect in any size or shape room.



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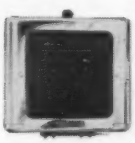
Utilize Electromode's efficient Down-flo principle. Clean, odorless, fan-circulated heat is evenly distributed throughout the area. Ideal for cold hallways, recreation rooms, and other big rooms. Come in both Recessed and Surface Mounted models. All have Electromode's exclusive Aluminum Safety Grid.



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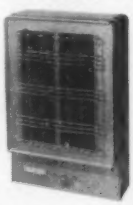
Just right for small rooms. Perfect for bathrooms, where extra warmth is frequently welcomed. Provides quick, economical warmth with the flip of a switch—at the temperature you select. Automatic thermostat keeps it there. Smart styling adds to bathroom beauty.

PORTABLE SUSPENSION TYPE

Especially useful for supplying extra heat in widely separated areas. May be plugged in temporarily or suspended from swivel-type brackets. Automatic thermostat. Adjustable louvers permit flexibility in directing fan-forced warmed air where most desired.



COMMERCIAL DOWN-FLO TYPE

Here are units that provide the perfect answer for many hard-to-heat areas. These sturdy heaters come in a wide range of capacities. Abundant, evenly fan-circulated warmth is assured for factories, auditoriums, schools, churches. Automatic thermostat is tamper-proof. Complete heat regulation may be arranged from a remote central control point.

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Electromode's complete line embraces more than 400 types, models and capacities of flameless electric heating units and systems for every purpose. Included are wide choices for residential, commercial, industrial and farm application.

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For more details on above items, use reply card on page 17

Inspectors to convene in Asheville

Southern Section, IAEI, will hold a three-day meeting during October

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers ✓
- Consulting Engineers ✓

◆ Asheville's Grove Park Inn will host the 33rd annual meeting of the Southern Section, International Association of Electrical Inspectors, to be held October 16 through 18, 1961.

The three-day meeting will include in its program the usual Code authorities, with Frank Camus and George Flach as moderators of the Code panel. It is expected that a significant portion of the time will be devoted to discussions of the proposed changes for the 1962 Code that have been approved by the electrical section of the National Fire Protection Association and the correlating committee.

In addition to the large number of Southern electrical inspectors expected to be present, there will be utility personnel, manufacturers' representatives, and others, all finding the scheduled discussion sessions of value in determining proper interpretations of Code requirements.

The usual scenic grandeur of Asheville in general and the Grove Park Inn in particular will be enhanced by the mid-autumn coloring of the foliage at the time of the meeting.

Attractions for delegates and their families include the Dogwood Trail, a self-conducted year-round tour of the city, its historical and scenic points of interest, and the outstanding residential sections.

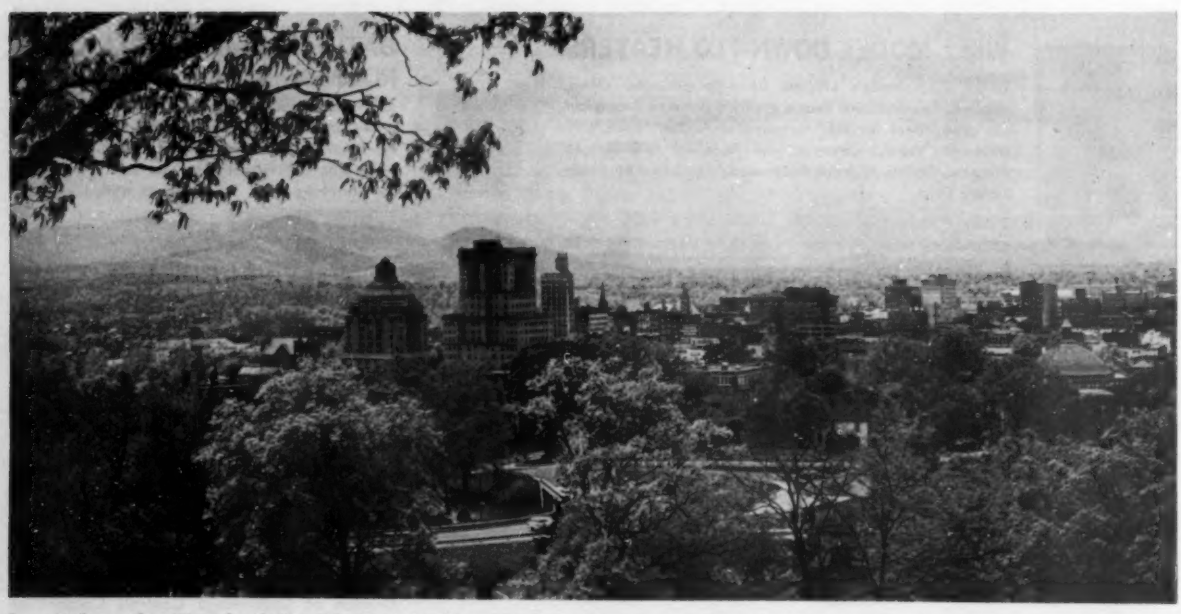
Biltmore House, the home of the late George Vanderbilt, is a 365-room chateau, the halls of which are lined with priceless antiques. The estate and gardens are open to visitors the year round.

The Thomas Wolfe Memorial, home of the world renowned author, is a shrine and open to the public.

Within a day's drive of Asheville are many natural wonders, including Chimney Rock, Mount Mitchell—the highest point east of the Mississippi, Whiteside Mountain, the Land of the Waterfalls, Grandfather Mountain, Blowing Rock, and such man-made wonders as Fontana Dam—the largest in the East, Oconaluftee Indian Village, and the Minerals Museum.

To the west of Asheville lies the Great Smoky Mountains National Park, a vast wilderness wonderland. Here, visitors and residents alike can swim, fish, hike, view the scenery, and relax.

To the east lies the scenic Blue Ridge Parkway, a roadway which connects Asheville and the Shenandoah Valley.



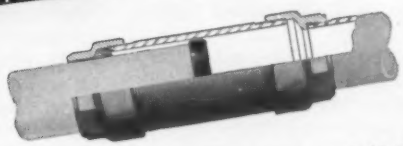
Located in the "Land of the Sky," Asheville, N. C., offers spectacular scenic beauty and many tourist attractions.

in the long run... it's O.Z.

Type AX

Provides 4" expansion, contraction movement. Malleable iron head, body Hot Dip Galvanized. Weatherproof head sealed by factory-installed high grade graphite packing. Insulating conduit end bushing eliminates cable abrasion. 10 sizes for conduit ½" to 4" diameters.

Type EX



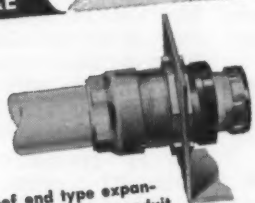
Permits 8" conduit movement. Optional length sleeves, additional cost. Weatherproof head sealed by factory-installed high grade graphite packing. Insulating bushings prevent cable abrasion. Hot Dip Galvanized finish. 12 sizes for ½" to 6" conduit diameters.

Type DX

Patented

Compensates for deflection, expansion, contraction. ¾" movement all directions from normal; 30° angular movement. Also used as vibration damper between conduit sections. 10 sizes. Watertight (NEMA 4) and submersible under 25 ft. head of water.

Type EXE



Weatherproof end type expansion fitting. Designed for conduit terminating in junction box, where expansion, contraction take place. Supplied complete: locknuts, bushings. Standard finish, Hot Dip Galvanized. 12 sizes.

Type TX

Similar to the Type AX, this unit is supplied complete with extension nipples, ready to receive thin wall couplings. Standard finish is cadmium plated. Available in 6 sizes for conduit ranging from ½" to 2".

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In the long run, no line of conduit is more dependable than its components. When it comes to dependability in expansion fittings, look to O. Z. as the line that measures up! Five basic types provide the dependable answer to your fitting problems in conduit expansion, contraction, and deflection. O. Z. is the dependable line because it's the line with the *right size*, the *right type*, for every requirement! Types AX, DX, EX and EXE available in aluminum at no extra cost.

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Application of Code requirements

The discussion of rules governing Class II installations is completed; Class III locations are redefined and rules for them are presented

By Walter R. Stone, Contributing Editor on Code Rules, Utica, N. Y.

◆ A discussion of the rules governing Class II installations will be completed, and a discussion of the rules governing Class III installations will begin in this issue.

Requirements for signal, alarm, remote-control, and local loudspeaker intercommunication systems for Class II, Division 1 locations are contained in Paragraph (a) of Section 502-14. These requirements are as follows: (The general requirements for communication systems, as distinct from intercommunication systems, are covered in Article 800.)

(1) The wiring method is required to be rigid metal conduit, electrical metallic tubing, or type MI cable with terminal fittings approved for the location where accidental damage or insulation failure could cause arcs, sparks, or high temperatures.

Derating of conductors in the raceways is not required where more than three conductors are used, and the number of conductors permitted in the raceways is not limited except that not more than 40 per cent raceway fill is permitted.

Where physical damage to the conductors is not likely to be severe, and where limited flexibility is needed, flexible cord approved for extra hard usage is permitted to be used.

(2) Switches, circuit breakers, relays, contactors, and fuses which may interrupt currents, other than voice currents, and any current-interrupting contacts for bells, horns, howlers, sirens, and similar devices which may produce arcs

---

Code test questions

1. For rigid conduit or electrical metallic tubing wiring methods, the number of remote-control circuit conductors in Class II, Division 1 locations are required to be limited only to the extent that the cross sectional area of all conductors does not exceed 40 per cent of the area of the raceway. True or false?

2. Current-breaking contacts for bells, sirens, and other devices in which sparks or arcs may be produced may be provided with general-purpose type enclosures in Class II, Division 1 locations if the contacts are immersed in oil. True or false?

3. Rectifiers and thermionic tubes may be provided with general-purpose type enclosures when installed in Class II, Division 1 locations. True or false?

4. In Class II, Division 2 locations, the windings of control transformers and choke coils are required to be provided with tight metal enclosures without ventilating openings. True or false?

5. Where dusts are of an electrically conducting nature, all wiring and equipment for local loudspeaker systems in Class II, Division 1 locations are required to be approved for Class II locations. True or false?

6. The wiring method employed in Class III, Division 1 locations shall be:

(a) rigid metal conduit or type MI cable.

(b) rigid metal conduit or electrical metallic tubing.

(c) rigid metal conduit or open wiring on insulators.

Which is correct? a? b? or c?

7. The wiring method employed in Class III, Division 2 locations may be:

(a) rigid metal conduit or type MI cable only, except that in areas or sections used solely for storage and containing no machinery, open wiring on insulators may be employed if properly installed and protected from physical damage.

(b) rigid conduit, type MI cable, or electrical metallic tubing only.

(c) any type of metal wiring system except where the use of machinery makes it necessary to use liquid-tight flexible conduit.

Which is correct? a? b? or c?

8. A Class III location is one which is hazardous by reason of:

(a) the presence of explosive dusts in suspension in the atmosphere.

(b) the presence of explosive mixtures of easily ignitible fibers and flyings in suspension in the atmosphere.

(c) the presence of easily ignitible fibers or flyings, but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitible mixtures.

Which is correct? a? b? or c?

9. In general, equipment in Class III locations should have maximum operating temperatures not in excess of:

(a) 120 C for equipment which is not subject to overloading and 165 C for equipment, such as motors and transformers, which is subject to overloading.

(b) 165 C for equipment which is not subject to overloading and 120 C for equipment, such as motors and transformers, which is subject to overloading.

(c) 190 C.

Which is correct? a? b? or c?

10. Boxes and fittings in Class III, Division 1 locations in which taps, joints, or terminal connections are made are required to be:

(a) explosion-proof.

(b) dust-ignition-proof.

(c) provided with telescoping or close-fitting covers and to be without openings through which, after installation, sparks or burning material might escape.

Which is correct? a? b? or c?

Correct answers will be found at end of article on page 115.

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electrical Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

or sparks are required to be provided with enclosures approved for the location except as follows:

General-purpose type enclosures are permitted to be used where current-interrupting contacts are immersed in oil or where the interruption of current occurs entirely within a chamber sealed against the entrance of dust.

(3) Resistors, transformers, and choke coils which may carry current, other than voice currents, and rectifiers, thermionic tubes, and similar heat-generating equipment are required to be provided with dust-ignition-proof enclosures approved for Class II locations.

(Notice that the principal difference in the types of equipment listed in Paragraphs (2) and (3) above is that the equipment in Paragraph (2) is current-interrupting or arcing equipment, and the equipment in Paragraph (3) is heat-generating equipment.)

(4) Rotating electrical machinery, such as generators and motors, is required to be dust-ignition-proof approved for Class II locations and to be totally enclosed not ventilated, totally enclosed pipe ventilated, or totally enclosed fan-cooled.

Such rotating machinery is not permitted to be installed in locations where dust from magnesium, aluminum, aluminum-bronze powders, or other similarly hazardous metal dusts are or may be present unless totally enclosed or totally enclosed, fan-cooled and unless specifically approved for such locations.

(5) Where dusts are of an electrically conducting nature, all wiring and equipment must be approved for Class II locations. Where dust from magnesium, aluminum, aluminum-bronze powders, or dusts from similarly hazardous metals are or may be present, all equipment must be specifically approved for such locations.

Paragraph (b) of Section 502-14 governs the installation and use of signal, alarm, remote-control, and local loudspeaker intercommunication systems in Class II, Division 2 locations as follows:

(1) Contacts are required to be provided with enclosures which either conform with the requirements for such enclosures which are located in Division 1, or with tight metal enclosures which are designed to minimize the entrance of dust and which have telescoping or tight-fitting covers and which have no openings, after installation, through which sparks or burning material could escape.

(2) Transformer and choke coil windings and terminal connections are required to be provided with tight metal enclosures without ventilating or other openings.

Resistors and resistance devices, thermionic tubes, and rectifiers are required to be provided with dust-ignition-proof enclosures approved for Class II locations except as follows: Thermionic tubes, non-adjustable type resistors, and rectifiers which have maximum operating temperatures not exceeding 120 C are permitted to be provided with general-purpose type enclosures.

(3) Rotating electrical machinery, such as generators and motors, is required to be totally enclosed not ventilated, totally enclosed pipe ventilated, or totally enclosed fan cooled except as follows:

Where dusts are non-conducting and non-abrasive and where, in the judgment of the Code enforcement authority, accumulations of such dusts will be so moderate as to be non-hazardous, and where the machinery and its associated equipment is readily accessible for cleaning and maintenance, the following type machines are permitted to be used:

Standard open type machines without sliding contacts, switching mechanisms, integral motor overcurrent devices, or internal resistance devices; or, standard open type machines which do have such contacts, switching mechanisms, or resistance devices which are enclosed within tight metal housings having no ventilating or other openings.

All exposed live parts are prohibited from being installed in any Class II, Division 1 or Division 2 location by the provisions of Section 502-15.

Grounding of wiring and equipment in Divisions 1 and 2 of Class II locations is required by Section 502-16 to comply with the following minimum requirements:

(1) All exposed, non-current-carrying metal parts of all equipment, raceways, and cable armor are required to be properly grounded in accordance with the provisions for grounding of such equipment in Article 250.

Grounding conductor

In general, this should be done by means of a bare or green-covered grounding conductor run with the circuit conductors. Also permissible, however, is "a separate grounding conductor installed the same as a grounding conductor for the conduit and the like."

Metal raceways and metal cable armors which are properly grounded are permitted to be used as the equipment grounding conductor. Other means of grounding such equipment may be used only by special permission.

The same method of grounding portable equipment with a grounding conductor run with the circuit conductors can be accomplished through grounding type receptacles which are themselves properly grounded and installed. A separate flexible strap or wire for grounding portable equipment may be used only by special permission.

(2) Neither locknuts and bushings nor double locknuts are permitted to be used as the sole means of bonding raceways and enclosures in Class II locations. Bonding jumpers with proper fittings or other approved means, such as threaded joints, are required to be used.

(3) Lightning protection devices are required to be provided for electrical services in Class II locations in areas where lightning disturbances are prevalent. Such devices are required to be installed in each ungrounded service conductor which is supplied from an ungrounded, overhead supply system.

The devices are required to be connected on the supply side of the service disconnecting means, and the ground connection from such devices is required to be bonded to the interior raceway system at the service entrance.

(4) Wiring in a Class II location which has a grounded service conductor and which is supplied by a grounded a-c system is required to have the grounded conductor bonded to the raceway system and service enclosure and to the common grounding conductor.

This bond interconnecting the

grounded circuit conductor, the raceway and enclosure equipment grounding conductor, and the common grounding conductor to the grounding electrode is required to be made on the supply side, and only on the supply side, of the service disconnecting means.

The grounded circuit conductor is required to be insulated from the raceways, enclosures, and other grounded equipment on the load side of the service disconnecting means in the same manner as the ungrounded circuit conductors. See Figure 1.

(5) Where wiring in a Class II location is supplied from an a-c transformer having a grounded a-c supply but which supplies an interior system which does not have a grounded service conductor, it is required to be provided with a bonding conductor between the supply system grounding conductor and the raceway system at the service entrance.

This bonding conductor is required to have a current-carrying capacity at least 1/5 that of the service conductors and in no case smaller than No. 10 soft copper or No. 12 medium or hard-drawn copper. See Figure 2.

(6) Where it may become necessary to abandon one or more grounding connections on a system having multiple grounds in order to prevent an objectionable flow of current over the grounding conductors, the grounding connections discussed in Paragraphs (4) and (5) above are required to be left intact as long as there is any other grounding connection connected to the supply system.

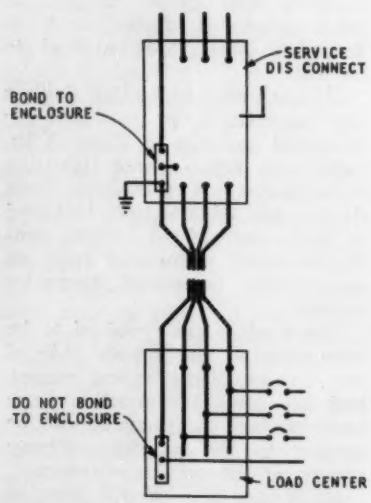

Fig. 1—In Class II locations, the metal raceways, metal enclosures, and grounded conductor are required to be bonded together at, or ahead of, the service switch and connected to the common ground electrode. Neutral bars at load centers are required to be insulated from ground.

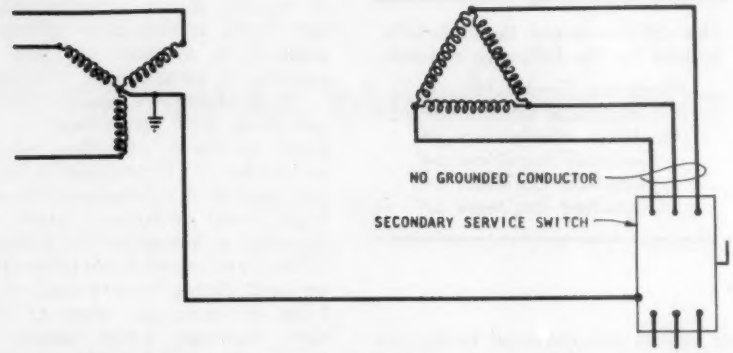

Fig. 2—When wiring in a Class II location is served from an interior system which does not have a grounded conductor but is served from a transformer having a grounded supply, then a bonding conductor one-fifth the size of service conductors is required to ground raceway and enclosures to the grounded supply. This facilitates the operation of the overcurrent device in the event of a phase-to-ground fault.

Class III locations

Class III locations, as explained in greater detail earlier, are locations which are hazardous by reason of the presence of easily ignitible fibers or flyings; but in which, unlike in Class II locations, such fibers or flyings, though easily ignitible and therefore hazardous, are not in suspension in the air in sufficient concentrated quantities to constitute ignitible or explosive mixtures.

A Class III location is deemed hazardous, therefore, not because of the likelihood of explosive mixtures, but because of the probability, if not properly treated, of spontaneous combustion resulting from excessive drying out and carbonization of the fibers and flyings by heat from the equipment as well as ignition from arcs and sparks.

(Class II locations are hazardous for these reasons also, of course; but Class II locations have the additional hazard of having explosive mixtures in the atmosphere.)

Class III, Division 1 locations are areas in which easily ignitible fibers or flyings or in which materials which produce combustible flyings are handled, manufactured, or used. This would include textile mills, cotton gins, clothing manufacturing plants, woodworking plants, and similar locations.

Class III, Division 2 locations are areas where easily ignitible fibers are stored or handled except in the process of manufacture.

The fine print note following Section 503-1 states, "Equipment installed in Class III locations should be able to function at full rating without developing surface temperatures high enough to cause excessive dehydration or gradual carbonization of accumulated fibers or flyings. Organic material which is carbonized or is excessively dry is highly susceptible to spontaneous ignition.

"In general, maximum surface temperatures under actual operating conditions should not exceed 165 C (329 F) for equipment which is not subject to overloading, and 120 C (248 F) for equipment such as motors, power transformers, etc., which may be overloaded."

Transformers and capacitors

Transformers and capacitors, when installed in Class III, Division 1 and 2 locations, must conform to the following requirements:

(1) Transformers and capacitors containing a liquid that will burn are required to be installed in transformer vaults conforming to the requirements of Part C of Article 450 governing transformers and transformer vaults.

(2) Transformers larger than 25 kva and containing Askarel are required to have an air space of not less than six inches between the transformer case and any combustible material and to be provided with pressure relief vents. The pressure relief vents are required to be connected to a flue or chimney leading to the outside

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When anyone pays us the compliment of calling some other make of fibre conduit "orangeburg type" please remember that "orangeburg type" does not mean Orangeburg Brand Fibre Conduit. That's the brand and quality made by us alone.

Vital electrical cables deserve the best protection and we have spent nearly 70 years trying to make Orangeburg Brand Fibre Conduit the best that money can buy.

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For more details on above items, use reply card on page 17

air unless means are provided for absorbing any gases generated inside of the case by arcing.

(3) Dry type transformers if not installed in vaults conforming to the requirements of Part C of Article 450 are required to be provided with tight metal housings without ventilating or other openings for enclosing their windings and terminal connections. Such dry type transformers are limited to operating potentials not exceeding 600 volts in such Class III locations.

Wiring methods

Paragraph (a) of Section 503-3 governs the wiring methods in Division 1 of Class III locations. These requirements are as follows:

(1) Rigid metal conduit and type MI cable are the only wiring methods permitted except where flexible connections are needed.

(2) Where flexible connections are necessary, dust-tight flexible connections, flexible metal conduit with approved fittings, or flexible cord approved for extra hard usage and provided with bushed fittings is required to be used.

A grounding conductor run with the circuit conductors in the flexible cord is required unless special permission from the inspection authority is obtained for using a different grounding method.

(3) Boxes and fittings containing taps, joints, or terminal connections are required to be provided with telescoping or close fitting covers which will effectively prevent the escape of arcs, sparks, or burning material and to be without openings through which, after installation, sparks or burning material could escape or through which adjacent combustible material could be ignited. Holes for mounting screws, if used, are required to be on the outside of such boxes or fittings, such as in outside "ears" or appendages.

Paragraph (b) of Section 503-3 governs the wiring requirements for Class III, Division 2 locations. These requirements are the same as those stipulated above for Division 1 locations except as follows:

Areas or sections which are used solely for storage and which contain no machinery are permitted to be wired by means of open wiring on insulators which is installed in conformity with the requirements for such wiring in Article 320, particularly the requirements in Section 320-12 for protection against physical damage to conductors which are not well out of reach of, or otherwise protected from, physical damage.

In Divisions 1 and 2 of Class III locations, circuit breakers, fuses, switches, and motor controllers,

(Continued on page 115)

Does Code not recognize certain sizes of conduit?

ADDITIONAL INFORMATION: In the May, 1961, issue of ELECTRICAL SOUTH the following question with our answer appeared: "Is it true that liquid-tight flexible metal conduit is not recognized by the Code in sizes larger than 1¼ inches? If so, why?"

The following additional information and comments have been received from A. M. (Gus) Miller, secretary-treasurer, IAEI, Southern Section, which we are happy to report:

"Not long ago I had a question concerning the reason for the 1¼-inch limitation on the subject material, in accordance with Section 351-3, and made inquiry of Bernie [B. A. McDonald, now deceased] as he was a member of Code Making Panel No. 8. I thought you might be interested in his reply from which the following is extracted:

" 'A review of the files of CMP No. 8 back in 1949-50 indicates that the thickness of the metal strip of this material is less than the minimum weight specified by U.L. for standard steel flexible conduit. As a result it is more vulnerable to mechanical or physical abuses and its function as a grounding conductor, to clear faults, is restricted accordingly.

" 'It is also significant to note in this respect that the conductor size is also limited to No. 2. In addition to the foregoing, this material is not required to satisfy the crushing and impact test applicable to standard flexible metal conduit.

" 'A summary of the foregoing indicates to me that the peculiar characteristics of this material are the factors which played an important part when the maximum size was established.'

"I also have a letter from Baron Whitaker, which in substance substantiates Bernie's views, which reads: 'I can only surmise that in the opinion of the Panel that the information presented in the report did not justify recognition in sizes beyond 1¼ inches because larger sizes were covered in the investigation.' " (Mr. Whitaker is vice-president of U.L. and chairman of the Code Correlating Committee.)

When we originally answered this question here, it was not known whether manufacturers had failed to request the necessary investigation for approval or whether the investigation had been made and the decision had been against recognition in the larger sizes. We are grateful to Gus Miller for making this information available to our readers.

Code interpretations clarify wiring rules

◆ Six interpretations of sections of the National Electrical Code were recently released by the National Fire Protection Association.

The interpretations, developed through the established committee procedure in response to requests, have been reviewed and released by the NFPA Electrical Correlating Committee. Subjects are:

(1) the installation of intrinsically safe control circuits;

(2) grounding of nonmetallic sheathed cable in a new installation;

(3) capacity of service entrance conductors when oversized feeders and main breakers are used to reduce voltage drop; and the provision of separate circuit breaker without use of main disconnect in an emergency lighting circuit placed ahead of main circuit breakers:

(4) installation limitations on a bare No. 6 grounding conductor;

(5) application of the 300-volt-to-ground limitation with regard to the installation of a bare neutral on customer-controlled services;

(6) application of Code require-

ments on the cable assembly connecting a combination ventilating hood and control panel for installation over a counter cooking unit, the entire assembly being one approved by a recognized testing laboratory.

The official texts of the interpretations follow:

Interpretation No. 462

Article 500

Statement: A low-voltage, low-current electrical circuit of such value that the circuit may be considered intrinsically safe has been designed for use in hazardous locations so that nonhazardous controls may be placed in the hazardous area to actuate circuit interrupting equipment installed outside the hazardous area. This circuit interrupting equipment controls high-energy circuits to equipment in the hazardous area. Both the high-energy circuits and equipment in the hazardous area are to be installed in full conformance with the applicable provisions of Article 500.

Question: May the intrinsically safe control circuit utilize, as part of the return circuit, the metal enclosure in which it is run without being in violation of the intent of the National Electrical Code?

Answer: No.

Interpretation No. 463

Sections 210-7 and 250-112

Statement: Grounding receptacles on a new installation are installed as specified by Section 210-22(b) and 250-59. The branch circuit wiring method is nonmetallic sheathed cable 14/2 without grounding conductor. A separate No. 14 copper conductor is installed as a grounding conductor from an adjacent water pipe to the grounding contacts of the grounding type receptacle. Proper fittings and devices are used as required by Code.

Question 1: Is the intent of Section 210-7 complied with under the above outlined condition?

Answer: No.

Question 2: Is it the intent of Section 210-7 that the grounding conductor be an integral part of the cable assembly supplying the grounding type receptacle?

Answer: Under the condition noted—yes. On existing two-wire nonmetallic sheathed cable, grounding may be through separate conductors to adjacent water pipe, as indicated in the last sentence of paragraph (a) of Section 250-112.

Interpretation No. 465

Section 230-90 and 230-70, (g)

Statement No. 1: The calculations for the wiring of a commercial establishment indicate that six feeders, each with conductor capacity of 100 amperes, would be ample to serve the load. This would normally require six 100-ampere circuit breakers and service entrance conductors of proper capacity for the calculated load. For the purpose of preventing voltage drop, however, two of the feeders were increased to 150-ampere sizes each, and four were increased to 125-ampere sizes each, and circuit breakers corresponding to the increased feeder sizes were proposed.

Question No. 1: In view of the increased circuit breaker ratings but with no increase in calculated load would the service entrance conductors as originally calculated comply with Section 230-90 of the Code?

Answer: Yes.

Statement No. 2: In the same layout just described, a separate circuit ahead of the six main circuit breakers is desired for emergency lighting as permitted by Section 230-72.

Question No. 2: Would the provision of a separate circuit breaker for this emergency lighting circuit, without the use of a main disconnect, comply with paragraph (g) of Section 230-70?

Answer: Yes.

Interpretation No. 466

Section 250-92, (a)

Statement No. 1: A bare No. 6 system grounding conductor for a commercial building is 120 feet long. This conductor runs through a four-inch concrete slab without being encased in conduit, electrical metallic tubing or cable armor.

Question No. 1: Is this permitted by Article 250, Section 250-92a of the N.E.C., 1959?

Answer: No.

Statement No. 2: Same situation as in "1" but the bare No. 6 system grounding conductor is laid on a sandy loam without conduit, electrical metallic tubing or cable armor enclosure and a four-inch concrete slab poured over it.

Question No. 2: Is this permitted by Article 250, Section 250-92a of the N.E.C., 1959?

Answer: No.

Statement No. 3: Same situation, but the bare No. 6 system grounding conductor is run perpendicular through a four-inch concrete slab and run below the slab in earth at a depth of one foot without a conduit, electrical metallic tubing, or armor cable enclosure.

Question No. 3: Is this permitted by Article 250, Section 250-92a of the N.E.C., 1959?

Answer: No.

Attention is also called to Section 230-30(a) Exception No. 2.

Interpretation No. 467

Section 230-4

Question: On customer-controlled services does Section 230-30 permit a bare neutral regardless of the voltage to ground, or does the 300-volt-to-ground limitation of Section 230-4 apply?

Answer: The 300-volt-to-ground limitation of Section 230-4 applies.

Interpretation No. 468

Notes to Tables 1, 2, and 3, Chapter 9

Statement: A manufacturer provides a combination hood-type ventilating fan and control panel for installation over a counter-insert cooking top. The manufacturer also provides as part of the assembly a length of flexible steel conduit (maximum length 15 feet) enclosing heat control switching conductors which terminates in female-type plug-in connectors for connecting the hood and the heating sections together. Connection to the branch circuit conductors is made at the combination ventilating hood and control panel. The entire assembly, including the connecting length of flexible steel conduit, is approved by a recognized testing laboratory.

Question 1: Is it intended that Section 210-19 paragraph c, Exception No. 2 be applied to the cable assembly connecting the combination ventilating hood and control panel to the cooking top unit?

Answer: No.

Question 2: Is it intended that Table 3, Chapter 9, be applied to the cable assembly connecting the combination ventilating hood and control panel to the cooking top unit?

Answer: No.

Comment: The short length of flexible steel conduit and the enclosed conductors are considered to be a part of the wiring of the appliance and as such are covered by the requirements of the standard under which the product is approved by the nationally recognized testing laboratory. See Section 90-8.

Contractors tell how

Compact device facilitates location of breaks in ceiling heating cables

◆ Some electrical contractors have greatly reduced the cost of call backs in connection with electrical heating cable faults.

Utilizing a signal generator to energize the cable with a special high frequency current, they quickly locate the breaks by means of an antenna probe, receiver, and ear set.

Developed by Electric Radiant Heat, Inc., of Fort Wayne, Ind., this fault finder can also be used to spot plastered over outlets, junction boxes, and wiring within walls.

The compact, transistorized, battery-operated unit consists of a transmitter signal pack, a receiver pick-up pack with a telescoping antenna probe, and an earphone headset. Each pack is about the size of a kingsize cigarette package.

Signal generator leads are attached to accessible embedded cable leads, which make each cable an extension of the signal generator antenna. The operator scans the ceiling with the antenna probe, and resulting signals are amplified into a small headset. Null zones indicate quickly and precisely where breaks are located.

Contractors can use this device to quickly locate heating cable trouble.

Cable pulling aided by unit on trailer

The cable pulling rig is built on a trailer which has a fifth wheel to give support from the front end.

By Harry J. Miller, Electrical South Field Editor, Sarasota, Fla.

◆ Electrical contractor Cliff Whitmore, working on the highly publicized Bird Key residential island development project at Sarasota, Fla., is using a rig for cable pulling which he describes as "a pearl beyond price."

The rig, which he had made in Miami by a firm well experienced in heavy electrical construction, is built on a trailer equipped with small heavy duty wheels.

The handle is part of a hydraulic system, and when it is pumped in one direction it lifts that end of the cable reel. When pumped in the opposite direction, it raises the opposite end of the reel. Thus leveling is simple and sure.

The unit needs no winch truck, because the trailer lifts the reel from ground level or deposits it there.

Long arms at either side of the reel are actuated by hydraulic pressure, and they move long racks with brackets on them. Thus the unit will pick up any size reel by simply giving the hydraulic unit a few strokes.

The unit even carries a spare tire.

Long arms at either side of the reel are actuated by hydraulic pressure, and move long racks with brackets.

Remote ballasts eliminate hum

By Ruel McDaniel, Electrical South Field Editor, Port Lavaca, Texas.

◆ Four private offices on the fourth floor of a bank building in Victoria, Texas, occupied by Braman-O'Connor, oil producers and ranchers, are fluorescent lighted without the usual slight hum emanating from such lighting.

The hum was eliminated by the use of 120 feet of conduit and ballast panels in two areas of the fourth floor.

Two ballast panels are utilized to do the job. One, in a new section of the building, contains individual ballasts, each serving as an individual unit.

In the remodeled old section of the structure, another panel carries the ballast in sections of four to the unit, and this one requires air conditioning and a fan to hold

Two Great New Series of
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ELECTRIC BASEBOARD

CL-A BASEBOARD

New Thermal Cut-out

CL-A Baseboard comes in complete 4', 6', 8' and 10' lengths designed for the fastest possible installation.

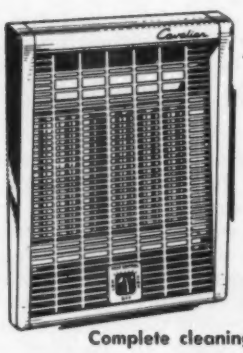
Thermostat not included with heating section. 250 watts per lineal foot at 240 volts.

CBB-F BASEBOARD

CBB-F Baseboard comes in 32" and 48" lengths, end caps, corner pieces, outlet section and thermostatic control section to provide utmost flexibility. Permits installation in almost any length which is a multiple of 16". 200 watts per lineal foot at 240 volts.

Both Series Have OUTSTANDING SAFETY FEATURES

Automatic thermal cut-out automatically cuts off electricity if air flow is obstructed. Low surface temperature. Fully enclosed heating element in tubular steel sheath with welded-on vertical fin to help radiate heat without obstructing air passage or creating dust traps.



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Safe! This is the first radiant convector heater with nickel-chromium wire embedded in cordierite ceramic, the finest ceramic known for heating elements and the safest construction yet devised. Sizes from 1.5 to 5 KW.

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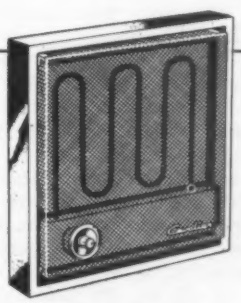

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down the accumulating heat in the multiple tube units. The cooling is possible by utilization of cool air from the central air-conditioning system, with a fan to direct the cooling air onto the ballast panel.

All offices, including the four with remote ballast panels, have luminous ceilings and each light tube has its individual ballast.

Connection between the lights and the remote ballast panels is through 120 feet of ¾-inch conduit, laid in the roof of the building. This was accomplished by laying the conduit as the concrete slab of the roof was poured, and since the fourth floor is also the top floor, this was possible without extensive extra wiring.

General contractor for the building construction was D. W. Marshall Construction Corp., which also handled the electrical and wiring installations.

The remote ballast idea completely solved the hum problem for the fourth-floor tenants, declares Berry Colvin, assistant vice-president of the bank, who was in charge of construction.

This is one of the remote ballast panels used to eliminate all traces of hum in a group of four offices illuminated by fluorescent lighting.

Promotion helps convert gas post lamps to electricity

By Bob King, Southwestern Editor, Dallas, Texas.

◆ A profitable promotion has been developed by an electrical contractor in Dallas, Texas, who stresses to prospective customers the savings and advantages of converting their gas post lamps to electric ready-lights.

C. F. "Andy" Andersen, owner of Andersen Electric Service Co., promotes the ready-lights through newspaper advertising, exhibits, and personal contacts.

Such aggressive promotion led to sales of more than 1,200 ready-light installations during the first year the firm actively pursued this type work, as well as the conversion of 25 to 30 post lamps from gas to electricity.

"We present a number of facts to a prospect," says Mr. Andersen, "such as how easy it is to change an electric bulb in comparison with a gas mantle, particularly since the gas company insists on sending out a serviceman to change the mantle, which results in an extra service charge."

Mr. Andersen has figured out expenses for the ready-light as compared to a gas post lamp, and points out to customers that the electric post lamp is more economical by three to one for cost of installation and operation.

C. F. Anderson has developed a profitable promotion of ready-lights.

"It will cost about eight to ten cents per month for the operation of the ready-light with the photo-electric cell unit," he claims, "as opposed to a cost of about 80 cents to $1 per month for the operation of the continuously burning gas lights."

A good point that has closed many sales for the firm in selling the electric post lamps is pointing out the usefulness of the weatherproof plug receptacle on the lamp post.

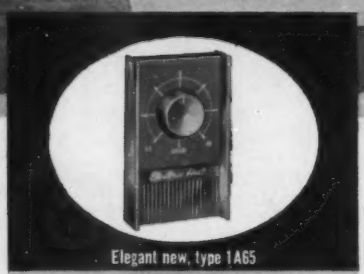
Customers are interested to learn the many things for which the convenience outlet can be used, such as the operation of their electric lawn mowers, edgers and trimmers, and other equipment, and also that it is particularly useful around Christmas time when they want to connect outside decorations.

In many of his newspaper advertisements, Mr. Andersen offers a weatherproof receptacle plug free when converting a gas post lamp to electricity.

"Recently," said Mr. Andersen, "we have been installing more of the ready-lights in the back yards

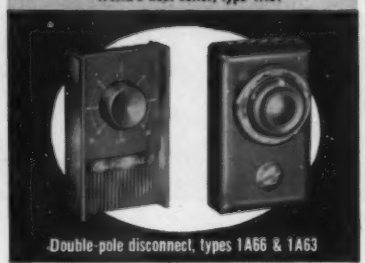
(Continued on page 115)

INSIST ON THE BEST in electric heat THERMOSTATS . . . "WHITE-RODGERS"

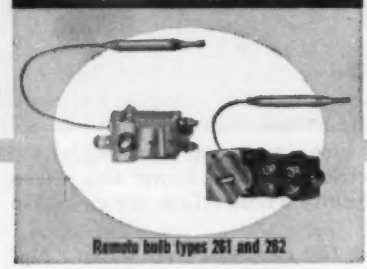


Elegant new, type 1A65

World's best seller, type 1A61



Double-pole disconnect, types 1A66 & 1A63



Remote bulb types 261 and 262

BEST– Designed

Elegant appearance created by designer Earl Claus, fits into any decor. Easy to install, simple to wire.

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Sensitive to *both* radiant heat and air temperature. Silent switch, rugged construction, dependable operation.

BEST SELLERS!

More than 50 manufacturers of electric heating equipment put their brands on these 'stats. Acceptance of White-Rodgers is several times greater than all other makes combined.

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If you use, install or specify electric heating, insist on White-Rodgers thermostats.

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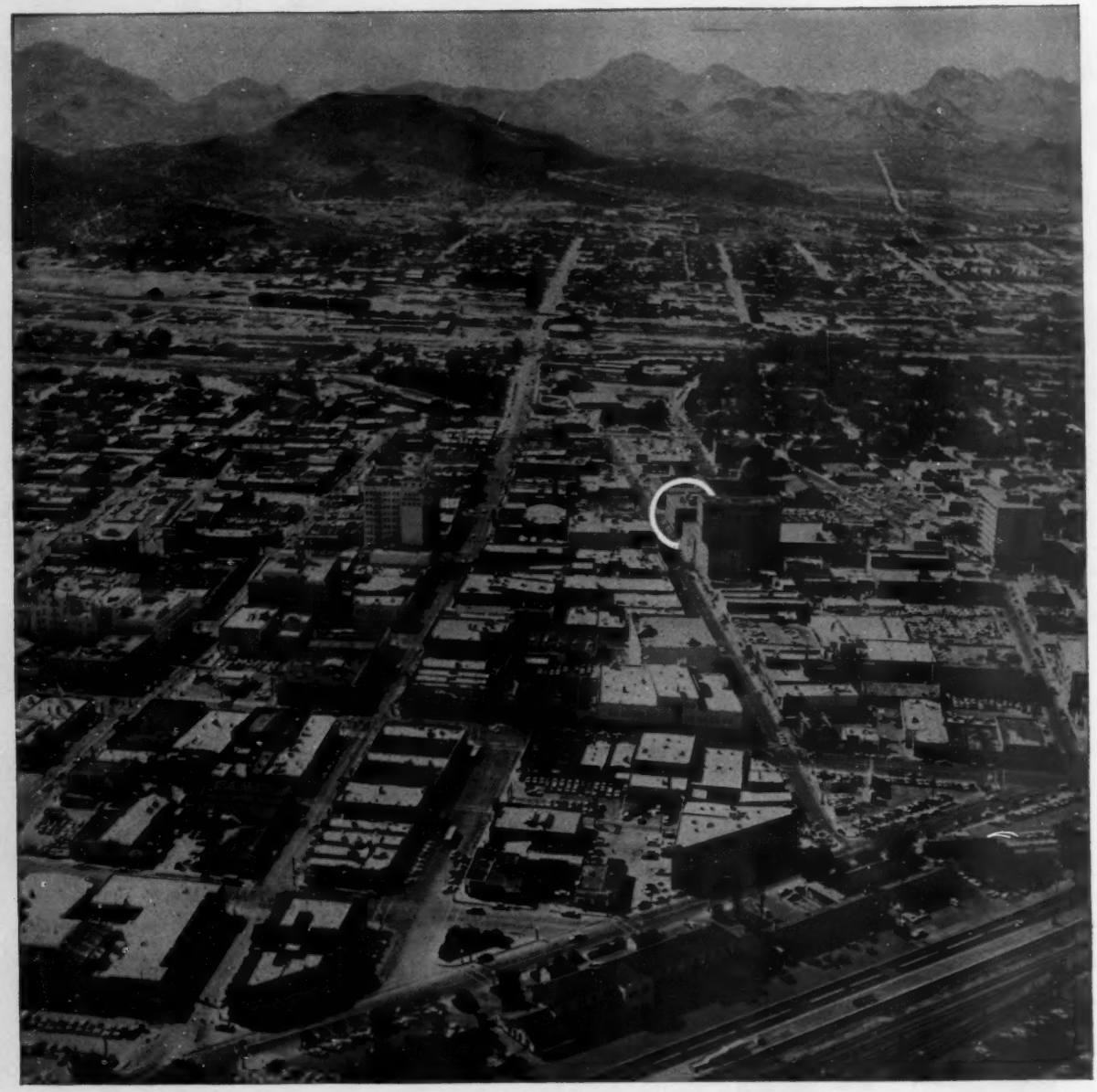

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Little wonder Tucson has grown from 262nd to 54th in rank among U.S. cities in the past ten years.

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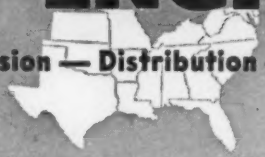

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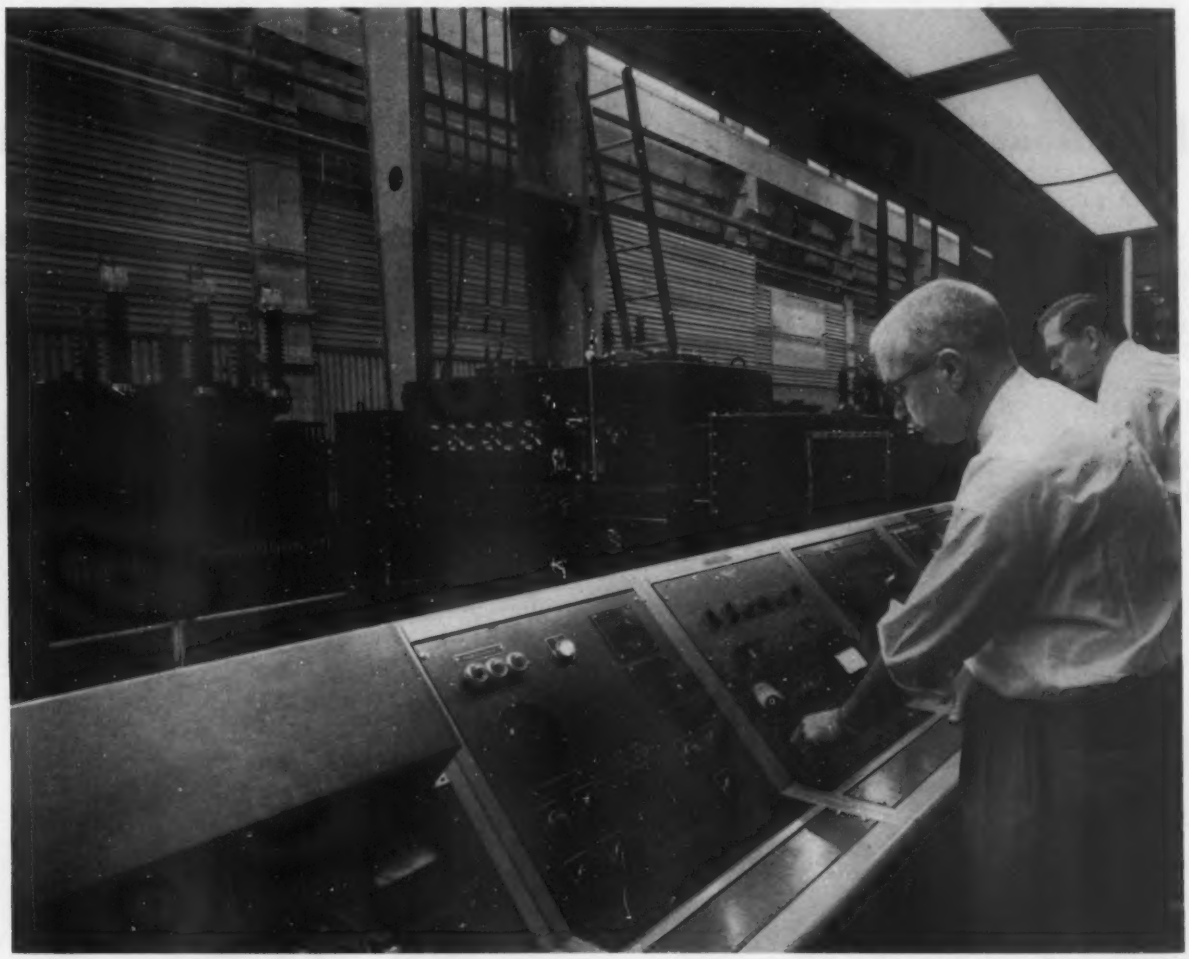

Semiautomatic test booth for transformers reduces test time by two-thirds (Westinghouse photo)

Hazards reduced in "bare hands" hot line work—page 66

Grounding transformers for system conversion—page 68

Application and operation of voltage regulators—page 70

G-E 65-degree transformer now in production—page 74

System voltage regulation analysis—page 78

New electric utility products—page 80

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Westinghouse metal-clad switchgear is design proved in the Westinghouse High Power Laboratory. It meets all industrial, electric utility, commercial, institutional, and other needs for 75 to 1000 mva service inclusive, 4.16 through 13.8 kv.

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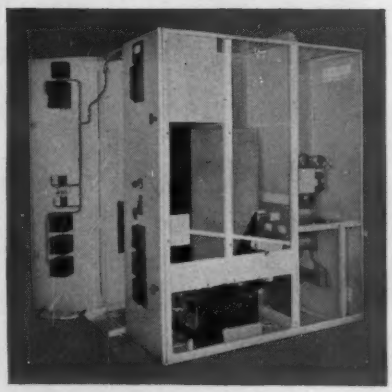
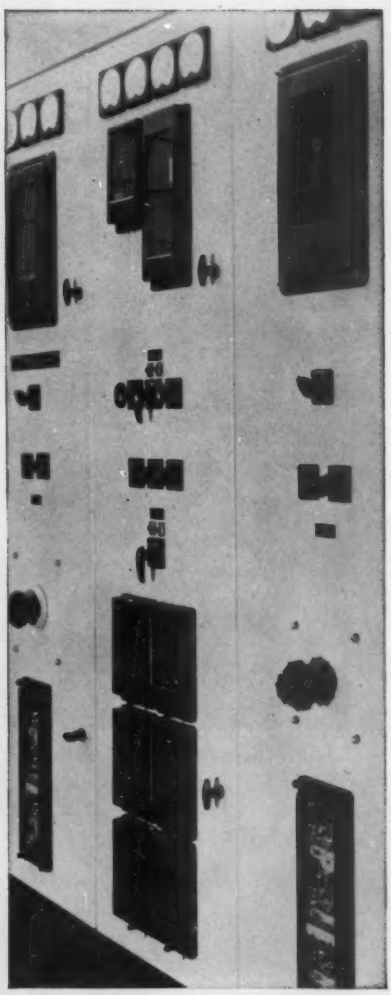
For further information, call your Westinghouse representative or write for a copy of Descriptive Bulletin 32-250 to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*



Balanced insulation protection is provided by the exclusive "Limitrak" insulation system on bus supports, arc chute enclosure and breaker bushings.

Fast, positive circuit protection is provided by the De-ion principle of arc interruption with center coil arc chute design.



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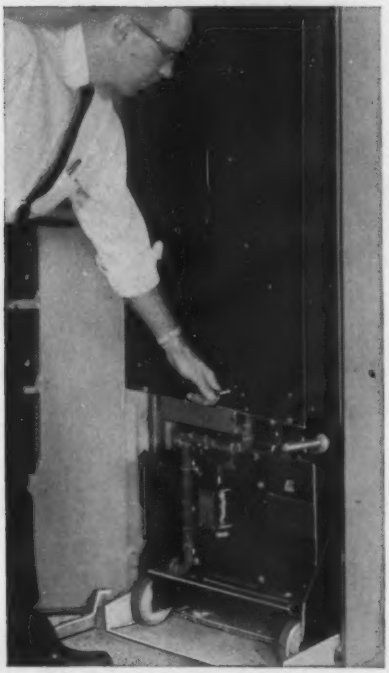

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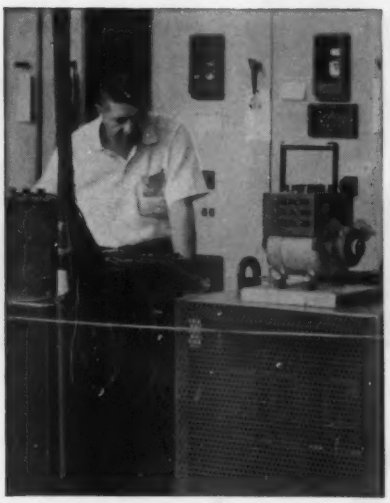
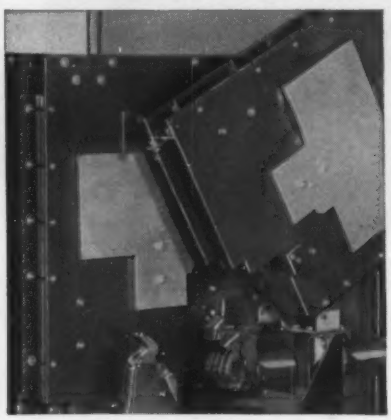
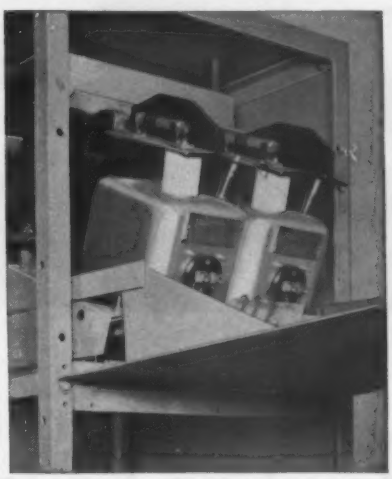
Complete joint sealing with polyester compound at main contact supports and main bus provides full insulation.



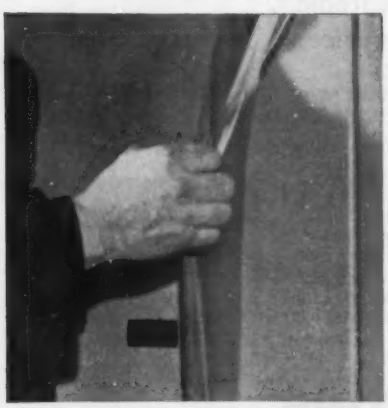
Proper component functioning is verified by a continuing program of production inspection and testing.



Hinged arc chute permits easy tilting for inspection and maintenance of contacts with DH breaker in drawout position.



Personnel are protected by separate compartment drawout-type mounting of potential transformers.



Front panel is protected during assembly, shipment and installation by strippable plastic coating.

Thorough phosphatizing and priming treatment safeguards against corrosion and provides a superior base for finish coat.

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Eliminating the hazards involved

Two important tower insulation requirements are involved in developing

By C. Clyde Crockett, Transportation Superintendent, Louisiana Power & Light Co., New Orleans, La.

◆ Much publicity has been given recently to the so-called "bare hands" technique of working on energized conductors from insulated aerial basket devices, but not enough caution has been sounded against the application of this technique to work on distribution circuits.

Essentially, the technique involves placing a conductive pad in the bottom of the basket and connecting this pad to the energized conductor, on which the lineman intends to work, by means of a flexible conductor and clamp.

The lineman is, therefore, energized constantly at the potential of the conductor and may handle it at will without encountering the harmless but annoying "shocks" associated with the capacitance charging effect each time he touches the conductor.

About seven years ago, Louisiana Power & Light Company first began to do hot line work on 14.4-kv circuits from aerial basket devices with rubber gloves. Rubber gloves were used then and are used now to eliminate these capacitance charging "shocks" because we believe that this is the safest way to do hot line work on distribution circuits from insulated aerial baskets.

Insulation requirements

In using aerial basket devices, there are two basic insulation requirements insofar as work on distribution circuits is concerned while there is only *one* in connection with work on transmission circuits.

In working on distribution circuits (34.5 kv and below) hot, we are concerned with, first of all, protecting the man in the basket from electrocution and, second, protecting the workmen and general public on the ground from electrocution by coming in contact with a "hot truck."

When we first began to use aerial basket devices for hot line work, we knew that this latter consideration would be more than solved if we could get manufacturers to develop a "completely insulated outer boom assembly." This concept was described and promoted on many occasions during the years from 1953 onward with all of the principal manufacturers of aerial basket devices with varying degrees of success.

Some merely wrapped the metal outer boom with insulating material which was not entirely satisfactory but did give a certain measure of protection to the people on the ground. Others "inserted" an insulating section in their metal outer booms and in the metal leveling cables.

All of these attempts by various manufacturers were well intended but did not achieve an adequately insulated device.

Finally, in May, 1958, one manufacturer exhibited the very first unit in which the outer boom itself was made of an insulating material; in this case, a spun fiberglass tube. This was quite an achievement in the development of adequately insulated aerial basket devices for work on or near energized conductors.

This, together with long glass insulators in the self-leveling cables and the use of nonconducting hoses for oil and air lines, produced a practically "insulated outer boom assembly." We say "practically," for in this case we could not classify the unit as having a "completely insulated outer boom assembly" since we still had metal cable riding over the sheave wheels at each end of the boom.

Under the most extreme positions, however, there was a minimum of six feet of fiberglass rod insulating the top of the boom from the bottom of the boom at the elbow joint. Since fiberglass, clean and dry, has an insulating value of about 100 kv per foot, it is readily seen that the minimum insulation from basket to ground by way of the boom, even when the insulation value was derated by 50 per cent for the insulators being damp and dirty, was in the order of 300 kv.

Since our standard transmission voltage up to then had been 120 kv or 69 kv phase-to-ground, we knew that, not only had we solved this part of the problem for distribution work, we had also solved the insulation problem for transmission hot line work.

Still bigger problem

The *bigger* problem of protecting the man in the basket when working on distribution circuits had yet to be solved. Obviously, when a man in a basket is working on distribution voltages which are generally installed on eight- or nine-foot crossarms, he has the hazard of accidentally coming into contact with phase wires or ground wires other than the one on which he is working at the moment.

This hazard is not present when working transmission voltages because of the much greater physical separation of conductors and, consequently, a well insulated basket here is of no importance.

On distribution work, however, the man's very life often depends on the insulation *through* the side wall or bottom of the basket in which he is standing.

Picture, if you will, a lineman in a basket working on one phase of a three-phase, four-wire, 24-kv feeder. The voltage of this phase to ground is about 14 kv. Also picture a grounded neutral wire against the side or bottom of the basket with the lineman's leg or foot directly opposite this ground wire, and you can readily see how important the basket insulation becomes when we talk about working distribution voltages hot.

To the man in this basket, that 300 kv of insulation from basket to ground by way of the boom is relatively unimportant—the insulation that protects *his* life is the

in 'bare hands' hot line work

this technique for safe work on electrical distribution circuits

insulation of the basket itself.

These hazards in doing distribution hot line work were recognized and we require all phase wires and grounded neutral wires within reach of the working position (other than the wire being worked on) to be covered with rubber line hoses, blankets, hoods, etc.

Extensive testing

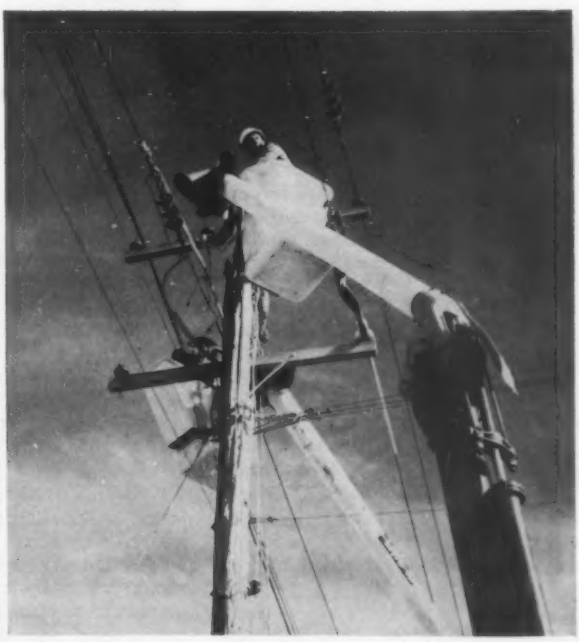
For seven years now, we have insisted that our baskets be tested at 45 kv for 30 seconds every two weeks or at any time upon the request of the lineman. Recently, we were successful in promoting the development of dense polyethylene basket liners for our baskets and have increased this test for the liners to 50 kv for one minute.

We still make routine dielectric tests every two weeks and will

(Continued on page 114)

Louisiana Power and Light uses single-basket units so that a lineman can change position freely without interfering with the other lineman.

Dense polyethylene basket liners have greatly improved the safety of working on distribution circuits hot.



Working distribution circuits hot requires great care as several potentials can be reached from one position.

Grounding transformers

Utility growth and modernization have brought

By Carl R. Larpenter, Electrical Design Engineer, Barnard and Burk, Inc., Consulting Engineers, Baton Rouge, La.

◆ Recent modernization and expansion programs of various municipal utility systems have resulted in the application of grounding transformer banks in order to adapt a three-phase, three-wire generating plant to a four-wire grounded neutral subtransmission or primary distribution system.

This adaptation becomes necessary in a situation where an existing plant designed for three-phase, three-wire operation is made to operate in parallel with a new plant designed for three-phase, four-wire operation.

The function of the grounding transformer bank in this particular application is to supply the unbalanced phase-to-neutral loads of the four-wire system by establishing a grounded neutral on the originally ungrounded three-wire system.

The grounding bank will function as a source of ground current in parallel with the grounded neutral of the new plant generator or separately in the event that the new plant is disconnected from the system. In addition to supplying the continuous unbalance required by the distribution system, the grounding bank also acts as a source of ground current for phase-ground faults on the system.

Types of grounding banks

Two general types of transformers are in use as grounding de-

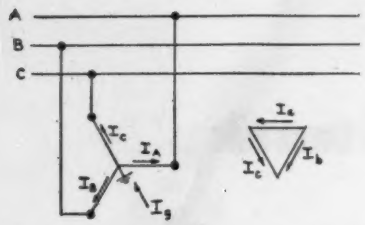


Fig. 1—In the wye-delta transformer the neutral point of the wye, or primary, is grounded and the open ends of the wye are connected to the three line conductors. The secondary windings are connected in delta.

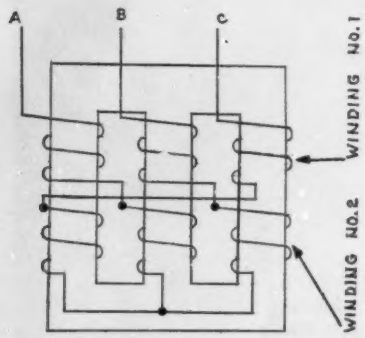


Fig. 2—The zig-zag grounding transformer consists of two windings on a common core for each phase.

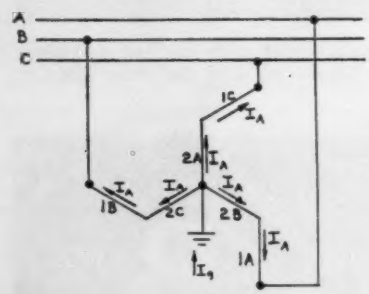


Fig. 3—For a current to flow through winding 1A, the same current must flow in winding 2B, since windings 1A and 2B are in series.

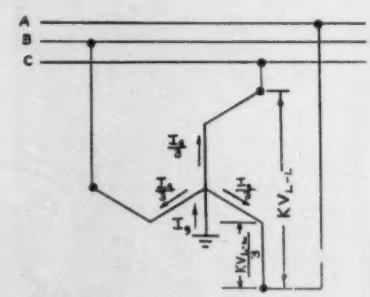


Fig. 6—Analysis of a voltage diagram will determine the kva rating of a zig-zag grounding transformer.

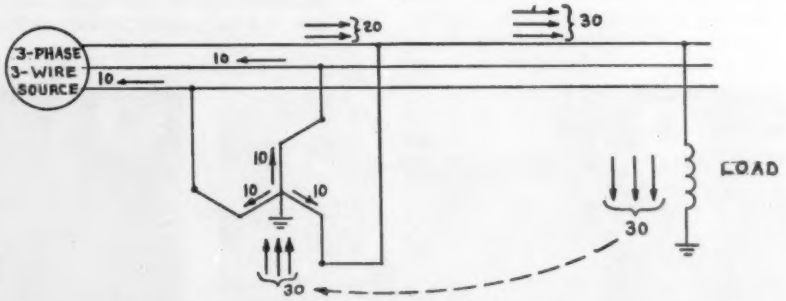


Fig. 4—This illustration shows the current flow in a zig-zag grounding bank and in external lines when supplying an unbalanced phase-ground load.

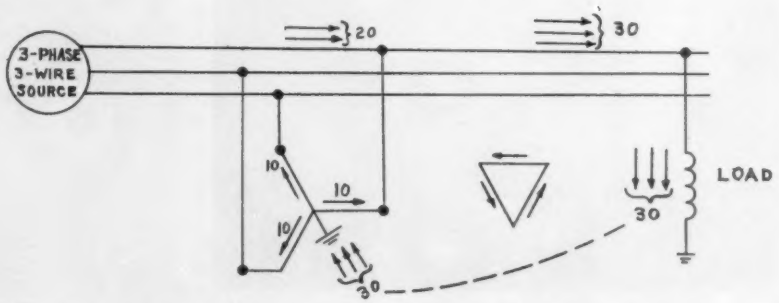


Fig. 5—The currents in a wye-delta bank resemble zig-zag bank currents.

for system conversions

the need for grounding transformer banks

vices: the wye-delta and the zig-zag.

In the wye-delta bank the neutral point of the wye (or primary) is grounded and the open ends of the wye are connected to the three line conductors. The secondary windings are connected in delta.

Referring to Figure 1, it can be seen that for a current I_a to flow in phase A of the wye connected windings, a current I_a must exist in A phase of the delta connected windings so that the ampere turns in A phase on the wye side are equal and opposite to the ampere turns in A phase on the delta side.

Also, for a current I_a to exist in A phase of the delta connected windings, a current $I_b = I_a$ must exist in the B phase, and a current $I_c = I_a$ must exist in the C phase of the delta connected windings since these currents flow in a closed delta with no external connections.

With current flow in B and C phases of the delta connected windings, corresponding currents must flow in the B and C phases of the wye connected side to satisfy the condition that the sum of the magneto-motive forces on each core leg equal zero.

Therefore, in order for a wye-delta transformer bank to allow current to flow from phase to ground, one set of three equal phase currents must exist in the wye connected windings ($I_A = I_B = I_C$) and another set of three equal phase currents must exist in the delta connected windings ($I_a = I_b = I_c$).

With no load on the delta connected windings, only exciting and magnetizing currents will flow from the system into the grounding bank.

The zig-zag grounding transformer consists also of two windings on a common core for each phase. The set of windings marked No. 1 (see Figure 2) are connected in series with windings marked No. 2 in such a manner that A phase of winding No. 1 is in series with B phase of winding No. 2, B phase of winding No. 1 in series with C phase of winding No. 2, and C phase of winding No. 1 in series with A phase of winding No. 2.

Terminals of windings No. 1 are connected to the three-phase conductors. Free terminals of windings No. 2 are joined to form a common point which is connected to ground.

Referring to Figure 3, it can be seen that for a current I_A to flow in winding 1A, the same current must flow in winding 2B, since 1A and 2B are in series.

However, for a current to exist in winding 2B, an equal and opposite current (with equal turn ratio) must flow in winding 1B, since 1B and 2B are on the same core leg. By continuing the above process it can be seen that equal currents must flow in all windings of the zig-zag transformer.

Therefore, in order for a zig-zag transformer to allow current to flow from ground to a faulted phase, three equal phase currents must exist in each set of windings connected to the line.

Analysis of current flow

The current flow in a zig-zag grounding bank and in external lines under the condition of supplying an unbalanced phase-ground load is illustrated in the following example.

Assume an unbalanced phase-ground load drawing 30 amperes. A current of 30 amperes to ground will produce a current of ten amperes per phase in the grounding transformer. The generation source of the three-phase, three-wire system will supply a current of 20 amperes in the phase with the unbalanced load. A current of ten amperes will flow in each of the unloaded phases.

As shown in Figure 5, a wye-delta bank will produce currents similar to a zig-zag transformer.

The value of impedance will determine the amount of ground-fault current that the grounding bank will supply and thus will determine its short time kva rating.

The impedance is selected so that the ratio X_o / X_1 does not exceed a value of three, where X_1 is the positive sequence impedance of the ungrounded system and X_o is the zero sequence impedance or (in this case) the impedance of the grounding bank.

A ratio of X_o/X_1 less than three will insure preventing the voltage on the unfaulted phases from becoming excessive in the event of a fault.

The continuous neutral current which can be provided by a grounding bank is usually specified as a percentage of the ground fault current rating. This value is usually in the order of ten per cent.

Kva rating

In order to determine the kva rating of a zig-zag grounding transformer, an analysis of the voltage diagram, Figure 6, shows that the voltage rating of each winding is $\frac{kv_{L-L}}{3}$ where kv_{L-L} is the line-to-line voltage. The current in each winding is $I_g / 3$, where I_g is the total ground current. Therefore, the short time kva rating of a zig-zag grounding bank is $\frac{kv_{L-L}}{3} \times I_g$ three-phase kva.

The kva rating for a wye-delta grounding bank is given by the expression $\frac{kv_{L-L}}{\sqrt{3}} \times I_g$.

From the above it is seen that the kva rating of a zig-zag grounding bank is less than the kva rating of a wye-delta grounding bank for the same value of neutral or ground fault current. In general, the cost also of the zig-zag bank is less than the cost of the wye-delta.

Economic comment

(Continued from page 4)

well give the American producers a real advantage both at home and abroad.

These factors can all contribute to the development of one of the greatest prosperous periods in the nation's history. They will not do the job, however, unless all Americans are willing to hold the line against the eroding forces of inflation. This is difficult when employment is relatively full and prosperous conditions exist, but it is the price that must be paid if sound economic development is desired.

Application and operation of voltage

Capacitors, in addition to improving power factor, affect the regulator

By Thomas J. Sillers, Regulator Dept., Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

(*This is part II of a two-part article by Mr. Sillers.*)

◆ Capacitors are installed to improve power factor, and it is not unusual for operators to inquire about how capacitors affect the regulator line-drop compensator.

It is sometimes baffling to see the regulator lower the voltage when reactance compensation is increased.

An analysis of the regulator control circuit shows what takes place at leading power factor. Consider the power circuit shown in Figure 7. It is desired to keep load center and distribution line voltage at 120 volts, when the line has three volts resistance drop and six volts reactance drop in terms of line-drop compensator settings.

Figure 8 shows a basic control circuit consisting of a voltage regulating relay and a line-drop compensator (LDC) set for three volts resistance and six volts reactance. These values simulate the resistance and reactance of the power circuits, and the voltage regulating relay maintains the voltage level of 120 volts at the load center.

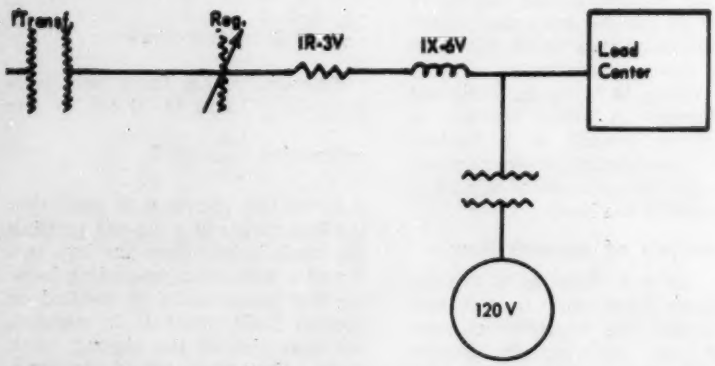


Fig. 7—An analysis of this power circuit with regulator shows what takes place at leading power factor with the load center and distribution line voltage at 120, three volts resistance drop in the line, and six volts reactance drop in terms of line-drop compensator settings.

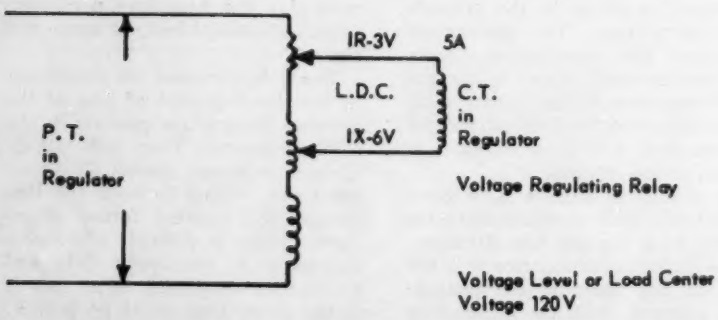


Fig. 8—This circuit has a voltage regulating relay and a line-drop compensator with resistance and reactance simulating a power circuit.

First consider lagging power factor. Figure 9 shows the electric diagram which applies to either the power circuit or the regulator control circuit. The load center voltage or, in other words, the voltage regulating relay voltage level of 120 volts, is used as a reference.

It is found that the full-load current of five amperes in the current transformer secondary requires the output voltage of the regulator to be 126 volts. By increasing the reactance setting of the line-drop compensator, the reactance drop would follow the dotted line.

It would then be necessary for the regulator to raise its output voltage to maintain the 120-volt level.

The electric diagram for leading power factor is shown in Figure 10. If the load center voltage is to be maintained at 120 volts, the regulator output voltage must be 119 volts. Should the reactance setting of the line-drop compensator be increased, the reactance drop would follow the dotted line shown and it would be necessary for the regulator to lower its output voltage to maintain the 120-volt level.

Therefore, if the operator should increase the reactance setting, the voltage regulator relay would correspondingly lower the voltage.

In the last example, it was assumed that capacitors are installed at the load center and that reactive kva goes through the entire power circuit as well as through the line-drop compensator circuit.

Capacitors at terminals

If capacitors are installed beyond the regulator but other than at the load center, the line-drop compensator settings of the regulator will not produce the correct voltage at the load center. For an extreme case, consider the capacitors installed at the load terminals of the regulator in Figure 11.

regulators

line-drop compensator

The power circuit will have a voltage drop as shown in Figure 12, but the line-drop compensator has no way of knowing the capacitors are not at the load center and will respond to a voltage drop as shown in the vector diagram of Figure 13.

The regulator itself is not seeing the same current that actually appears at the load center. Therefore, if capacitors are to be installed in the same station as the regulator, it is better to connect them to the source side of the regulator. In this way, correct line-drop compensation will be obtained.

Many times, of course, it is desirable to install capacitors beyond the regulator but not at the load center. The regulator will act as if the capacitor were at the load center and this may upset the load center voltage. This can be overcome by increasing the voltage level of the regulating relay.

Figure 14 shows the circuit with capacitors installed between the regulator and the load center, and some distance from the regulator. If the capacitors are distributed, they are assumed lumped at this point. The vector diagram for the control circuit without the capacitors is shown by the solid lines in Figure 15, and the effect of the capacitor is shown by the dotted lines.

If the capacitors are at the load center (distance **b** equals 0), then the control vector diagram will be the same as the power vector diagram and is correct. However, if the capacitors are at the regulator (distance **a** equals 0), the control vector diagram will include the capacitor effect but the power circuit will not.

Correction factor

The regulator output voltage will be 123 volts when it should be 126. This could be corrected by increasing the voltage level of the voltage regulating relay by 126 minus 123 or three volts. If the

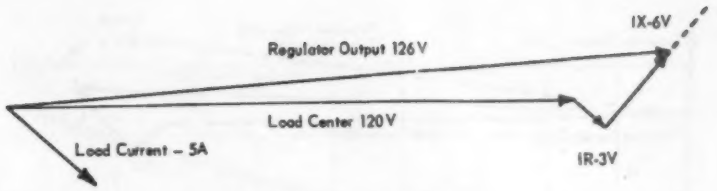


Fig. 9—With 80 per cent lagging power factor, this is the electric diagram which applies to either the power or regulator control circuits.

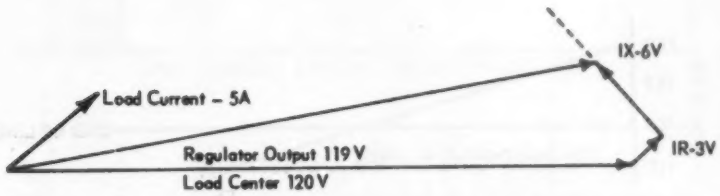


Fig. 10—This is the diagram for 80 per cent leading power factor.

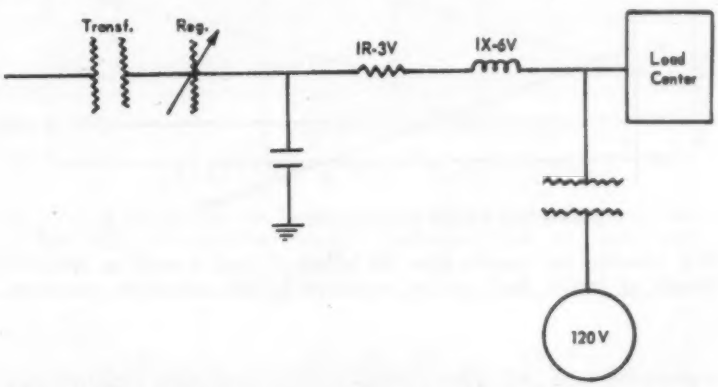


Fig. 11—Capacitors are at regulator load terminals of this circuit.

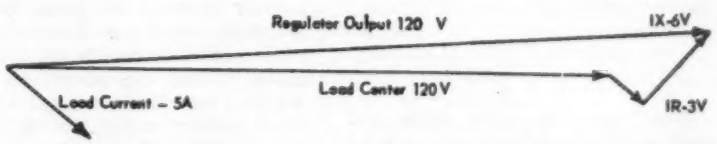


Fig. 12—Vectors represent load circuit at 80 per cent power factor.

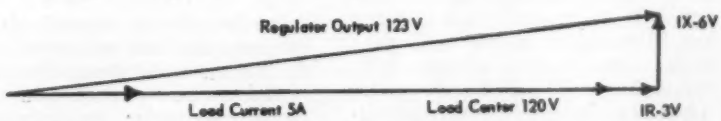


Fig. 13—Vectors represent the control circuit at unity power factor.

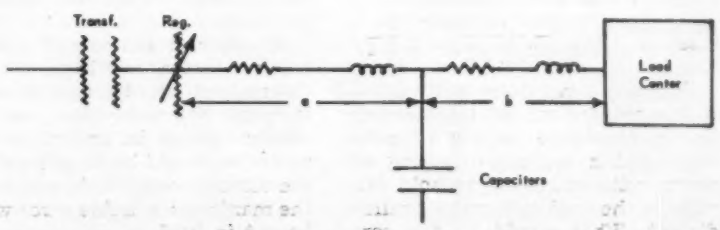


Fig. 14—Capacitors are placed between the regulator and load center.

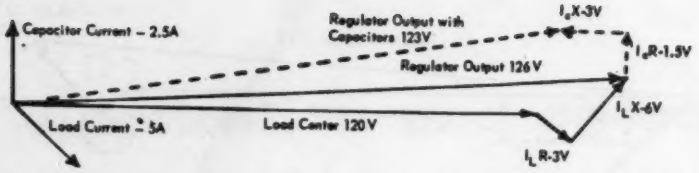


Fig. 15—Vectors show the circuit without the capacitors installed by the solid lines and the effect of the capacitor by the dotted lines.

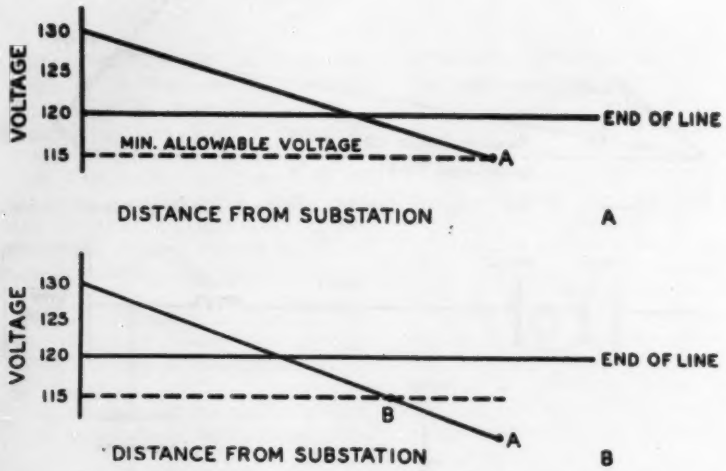


Fig. 16—The two graphs show the effect of load growth on effective length of feeder that can be regulated by the substation regulator.

capacitors are at some intermediate distance between the regulators and the load center, then the three volts correction should be multiplied by

$$\frac{b}{b + a}$$

Note that the three volts correction is essentially a voltage drop in the reactance element of the line-drop compensator caused by the capacitor current. The voltage drop in the resistance element has little effect unless it is very large, since it is in quadrature with the control voltage. Therefore, the correction factor can be approximately determined by the following formula.

$$\text{(Voltage level increase)} = \left(\frac{\text{Reactance}}{\text{setting}}\right)\frac{\text{(Capacitor current)}}{\left(\frac{\text{Primary rating of}}{\text{regulator CT}}\right)}\left(\frac{b}{b + a}\right)$$

Suppose a regulator with a 300 to five ampere current transformer has a reactance setting of nine volts and a resistance setting of seven volts and is set to hold 120 volts at the load center three miles distant. What would be the corrected relay setting if 750 kvar of capacitors are installed one mile from the regulator?

Assuming the circuit is 4,330 volts, three-phase, then the capacitor current is equal to 100 amperes. Distance **a** equals one mile and distance **b** equals two miles. Using the above formula, we find that the corrected voltage level setting should be 120 plus two, or 122 volts:

$$\left(9\right)\left(\frac{100}{300}\right)\left(\frac{2}{2 + 1}\right) = 2$$

In the above example it was assumed that the capacitors are in the circuit at all times. Should the capacitors be switched, adding the correction factor could make a load center voltage correct when the capacitors are in the circuit and incorrect when the capacitors are not.

Whether or not to add the correction factor could possibly be determined by deciding when it is more important that the load center voltage be correct. An alternative would be to add one-half the correction factor, in which case the maximum possible error would be cut in half.

Should the capacitors be installed at a point beyond the load center, the regulator will act as if the capacitors were at the load center and will maintain the load center voltage correctly. Corrective measures are needed only when the capacitors are between the regulator and the load center.

Re-regulation

A regulator is used on a feeder primarily to maintain a voltage between some maximum and minimum allowable voltages. Initially a regulator or bank of regulators in a substation may provide a voltage throughout the feeder with a potential which is within the allowable tolerances.

However, with load growth it may be found that voltage eventually will drop below the minimum allowable voltage at some distance down the feeder. Figures 16A and 16B illustrate this condition. It would then be necessary to add a second regulator at the point B on Figure 16B. As time goes on it may be found necessary to add still more regulators to a particular feeder.

The end result is that there are several regulators in cascade on a particular feeder. Questions then arise as to whether or not any changes should be made to the control setting on the regulator. Primary concern is with settings on the regulator time-delay devices.

It is thought that regulators closest to the substation should act first and the one farthest from the substation should be last to act.

Tests have been run, however, on feeders with a number of regulators cascaded. These tests were run at both conditions — that is, with different time delays set on the regulators and then with all regulators set at the same time delay.

The results showed that there was not an excessive number of operations with the time delays all set at the same value. There was no appreciable difference between the number of operations with either arrangement.

It may be concluded that if a number of regulators were to be cascaded on a particular system there would be no excessive operation if all time delays were set the same. However, if it were desirable to have different time delays set, the shortest delay should be at the regulator closest to the substation.

This has been a generalization

and it should be remembered that on individual feeders the particular load conditions of that feeder should be taken into consideration in arriving at the proper operation of the regulator.

Savings realized in the use of distribution type regulating equipment could be used to provide re-regulation on the system at a point between the substation and the end of the feeders. This could be considered as a means of reducing the voltage swings on the line and also a means of increasing the usable length of the feeder.

Consider the voltage profiles of Figure 17. These profiles apply to a system that has a load at the end of the line and it is, for most cases, a simplification. However, it does demonstrate several points.

Figure 17A shows a profile if a plus and minus ten per cent regulator is used in the substation and the load is such that the regulator is at full boost. Figure 17B shows the same system if a plus or minus five per cent regulator is used in the substation and a distribution regulator is installed at point (1).

The point on the system where

(Continued on next page)

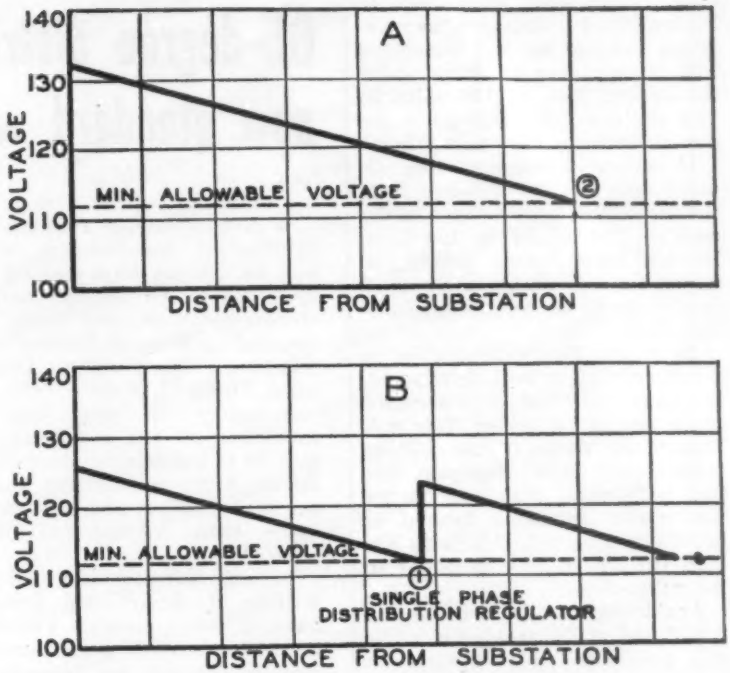


Fig. 17—As the graphs show, using reduced initial regulation in conjunction with re-regulation provides better voltage at lower cost.

Fifty-kva inverter uses silicon-controlled rectifiers

◆A laboratory development expected to have important effect upon the application of new sources of electric power was disclosed recently by the General Electric Co.

The company said its general engineering laboratory has designed and successfully tested the first working model yet announced of a high-capacity "solid state" electronic device for converting direct current to alternating current.

It has no moving parts, other than two fans, and it does the work of a 60-hp motor-generator set which is almost three times as heavy.

With a rating of 50 kva, the new inverter has ten times the power-handling capacity of units of this type announced up to now.

R. A. Koehler of the engineering laboratory said the 50-kva inverter will help solve what has been a difficult problem in development work on new power sources. The problem, he said, is that electric power generated by such means as fuel cells and solar energy is always in the form of direct current.

Most applications, on the other hand, require that this be converted — and at low cost — into alternating current.

Many uses of electricity produced by the new power sources are expected to be in situations where motor - generator sets, normally used for conversion, would be unsuitable because of weight or maintenance factors.

It was explained that the solid state inverter should be especially useful, because of its low maintenance requirements, in isolated installations where apparatus must operate unattended. Extremely low maintenance is seen for the inverter, in view of the fact that it has no moving parts to wear out and thus requires no lubrication. Its reliability is expected to be exceptionally high.

The inverter operates almost noiselessly — an important characteristic for some military applications, as in a submarine.

Actual conversion of power from d.c. to a.c. is accomplished by silicon-controlled rectifiers which operate instantaneously and require no warm-up.

Converting power from d.c. to a.c. by electronic means was described as a totally different and vastly more difficult procedure than converting from a.c. to d.c.

Compared with other methods of converting electric power from direct current to alternating current by solid state devices—notably transistors—silicon-controlled rectifiers show by far the best promise, the announcement said, for economical and high-capacity operation.

The 50-kva model has been designed for actual use in the engineering laboratory, and is housed in a metal cabinet mounted on wheels. The a-c power output is provided at frequencies varying from 50 to 500 cycles. Adjustable frequencies are easy to obtain with the new solid state inverter, it was explained.

the minimum allowable voltage is found has been moved farther away from the substation in Figure 17B. Furthermore, the maximum voltage on the system of 17B is only five per cent above the desired level of 120 volts. In 17A the maximum voltage is ten per cent above the desired level.

If several customers were located only a short distance from the substation, their voltage in the case of 17A would be too high. By the same token, voltage to customers located beyond point 2 of 17A would be below the allowable limit.

As stated, Figure 17 applies to a system with a load at the end. Normally, the load is distributed along the entire feeder. This will change the shape of the voltage profile very little. However, this fact will mean that kva of the distribution regulator located at point 1 of Figure 17B will be less than the kva of the regulator in the substation.

Again, this will reduce the initial cost of the regulation while still providing better voltage on the feeder. In addition, the feeder can now be extended while still maintaining greater than minimum system voltage.

It has been shown that a plus and minus ten per cent range of regulation is adequate to correct the voltage variations on the majority of the electrical systems throughout the country. It has also been shown that by using a band width equal to two steps of the regulator many advantages will be obtained.

Because regulators are not always located at the load center, the line-drop compensator is available to minimize the effects of resistance and reactance drops and give better voltage at the load center. If capacitors are located between the regulator and the load center, the effects of the capacitor must be taken into account where applying compensation.

When cascading regulators on a line, it is possible to use smaller kva size regulators with reduced regulation to provide better overall voltage and at the same time benefit by savings on investment.

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(2) "Introduction to Voltage Regulation," Allis-Chalmers Mfg. Co., Publication 21R8106.
(3) "Economic Basis for Choosing Voltage Regulating Equipment," R. F. Gilton, Allis-Chalmers Mfg. Co., Publication 21R8751-1.
(4) "Proper Regulator Compensation," Howard C. Brem and R. F. Gilton, Allis-Chalmers Mfg. Co., Publication 21R8751-7.

65-degree distribution transformers now standard with General Electric

◆ A new line of Permalex 65 distribution transformers which will reduce the total owning cost of transformers for the nation's electric utilities has been announced by General Electric's Distribution Transformer Department, Pittsfield, Mass.

Presently in production in ratings of 167 kva and below, the new 65 C transformer designs are up to 15 per cent lighter and 12 per cent smaller, and have lower losses than conventional 55 C units.

Department marketing manager William R. Smart said development of the company's Permalex insulation system and dual-kva units in the past few years led to the new 65 C transformer design which will be offered at a purchase price up to 10% lower than previous 55 C designs.

"The reduced prices became effective July 9," Smart added, "and all purchases since that date will be billed at the new price levels."

"Adoption of the 65 C design makes full use of the economic advantages of Permalex insulation's superior thermal capability," Smart said. "The Permalex 65 line results in transformers which are lighter and smaller and thus decrease installation and changeout costs. They also provide lower losses and better regulation, resulting in lower operating costs for utilities."

Lower manufacturing costs for the new 65 C design, and a continuing trend toward standardization on preferred-kva ratings permit the price reduction, according to Smart. "We have analyzed our costs, including the change in cost pattern across our entire distribution transformer line due to shifts in volume in major voltage and kva sizes. Savings have been assigned to each rating where the savings actually will occur, rather than arbitrarily taking some 'average' percentage off the price of all ratings, and therefore the amount of price reduction varies with the kva and voltage rating," Smart said.

Smart also said it is the fifth price reduction since 1957 in General Electric's continuing program to share manufacturing cost saving with electric utility customers.

A major contributing factor in the development of the Permalex 65 design was the result of a year-long survey in which the majority of electric utilities indicated their desire for a high-temperature transformer which would lower the total cost of owning and operating transformers.

The new Permalex 65 distribution transformer will be the only line of transformers manufactured by the department since the new design offers all the advantages of the 55 C design, plus greater economy. Smart said that "to retain the 55 C design now would be to ignore the technological advances in insulation which have been made, and hinder the utility industry in its efforts to keep costs down."

Prices for the remaining 55/65 C distribution transformers still in stock have been reduced to the new price level. Since the electrical and operating characteristics of both lines are approximately the same, the department anticipates a smooth transition from the old transformers to the new.

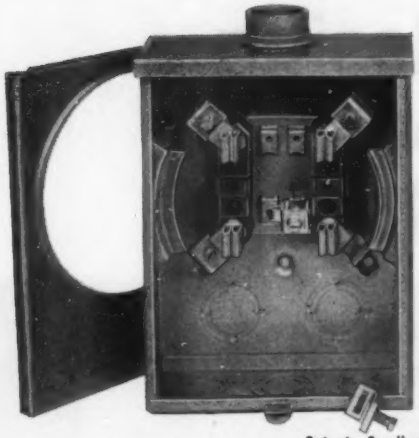
Prices on distribution transformers above 15 kv and pad-mounted transformers have also been changed, according to Smart.

The department will begin manufacture of Permalex 65 transformers, 15 kv and below, in the 250-500 kva range shortly.

Heat pump sales

(Continued from page 41)

built before the days of modern home conveniences, he does get calls for estimates on such homes. Occasionally an owner who already has that type of house and can't very well swap it off for a more modern one seeks Mr. Kimbro's help in making the best of that situation. In such a case Mr. Kimbro may arrange to install gas heat along with central air conditioning.



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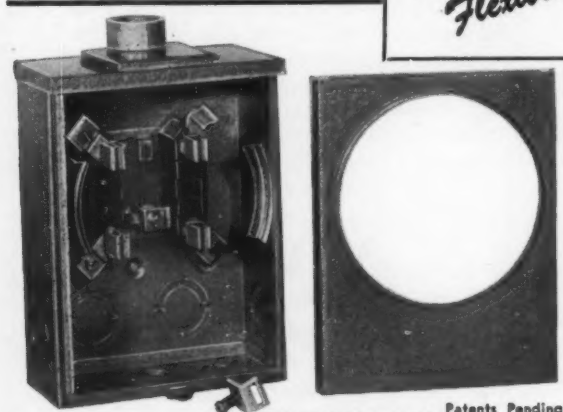

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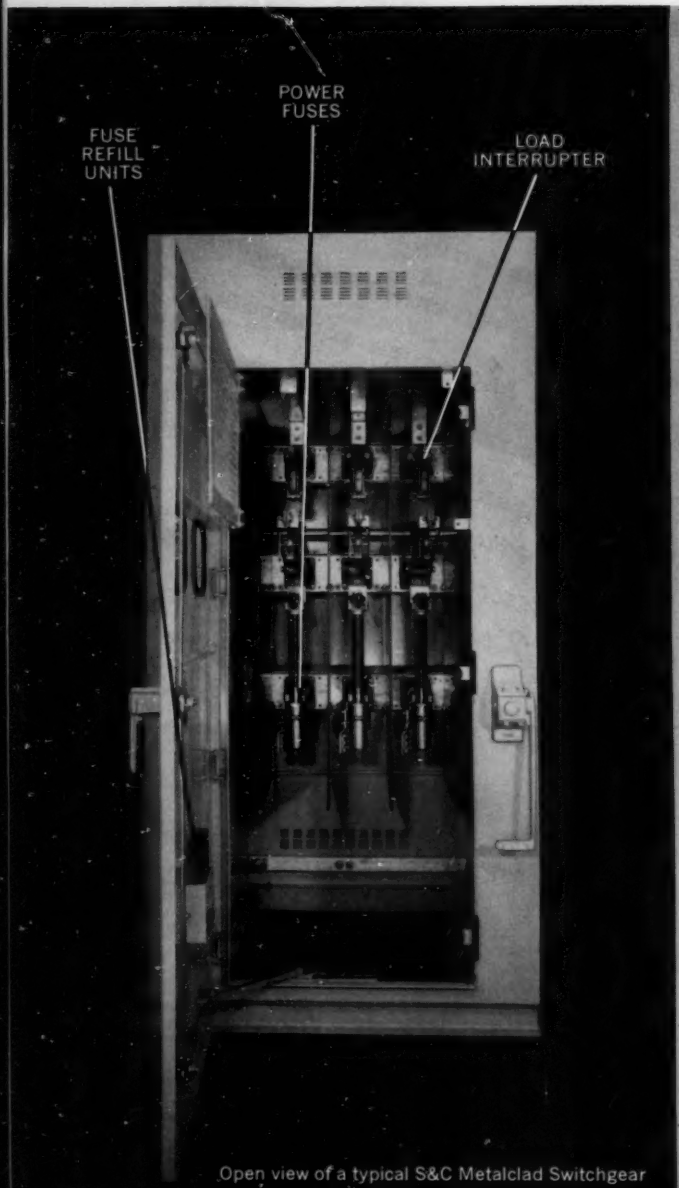
Reclosing is for the birds



Open view of a typical S&C Metalclad Switchgear bay. Note power fuses, load interrupters. Fuse refill units are conveniently stored in the door.

So why buy this feature in your 2.4 thru 14.4-kv switchgear?

Reclosing is for the birds, squirrels, tree limbs, lightning, icing, windstorms, and kite strings that frequently cause non-persistent faults on open distribution lines of utility systems. Reclosing re-energizes the lines to restore service in a fraction of a minute.

But when faults occur on the enclosed power supply circuits of industrial plants, commercial and institutional buildings, you don't want to reclose on them. These faults —while extremely rare—are permanent. Someone has to locate the trouble and repair the equipment or cable—or at least isolate it—before the system can be re-energized. So why buy expensive circuit breaker type switchgear with its automatic reclosing feature?

S&C Metalclad Switchgear—employing fused load interrupters—gives the ideal protection for enclosed power supply circuits. Power fuses furnish the fault protection (load interrupters switch the load). After a fault occurs, you simply replace the inexpensive fuse refill unit (typically costing $13.50) while the fault is being located and corrected.

The economics all say, "Reclosing is for the birds." Why pay for a function you can't use?

Cut your high-voltage switchgear costs in half by specifying S&C Metalclad Switchgear for your 2.4 thru 14.4-kv switching centers, service entrances, substation primaries and secondaries. Get full-load switching to 1200 amperes and fault interrupting to 500,000 kva.

See the Yellow Pages (Electrical Equipment) for your nearest S&C sales engineer. Or write to:

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The equipment is an S&C Metalclad Switchgear Assembly rated 13.8 kv, for a switching center.
The bird, a green-winged macaw, is an optional extra, obtainable at your local petshop.

For more details on above items, use reply card on page 17

System voltage regulation analysis

II—Of importance are relationships of voltage to operation of system interconnections and generator terminal voltage to steady state stability

By Arnold L. Samuels, Electrical Engineer, Kansas City Power and Light Co., Kansas City, Mo.

(This is the second part of a three-part article discussing the problems involved in operating a system voltage regulation plan.)

◆ An evaluation of voltage is of importance when the performance of system interconnections is being considered.

The voltages of interest are those which express operational limits, as the angle between internal voltages back of sending and receiving system equivalent reactance, or voltages which are maintained constant at the terminals of the system generators.

Several bus locations in the interconnected system will have voltages of interest where interconnection operation is affected.

These include (1) the terminals of the interconnection being studied, (2) load tap points along the interconnection, (3) points of known constant voltage which are maintained by generator or synchronous condenser excitation, and (4) the voltages behind the equivalent generator synchronous reactances of the sending and receiving systems.

Voltage at the receiving terminus of a tie between systems may be representative of the receiving system load bus voltage. When heavy transfers of power are being considered across the interconnection, the voltage measured at the receiving end of the intersystem tie will be representative of the expected voltage under that condition.

An analysis to determine voltages at locations along the interconnection where loads have been tapped is useful to impose limits on the power flow across the interconnection so that voltages will not fall below the minimum allowable.

If voltages at intermediate

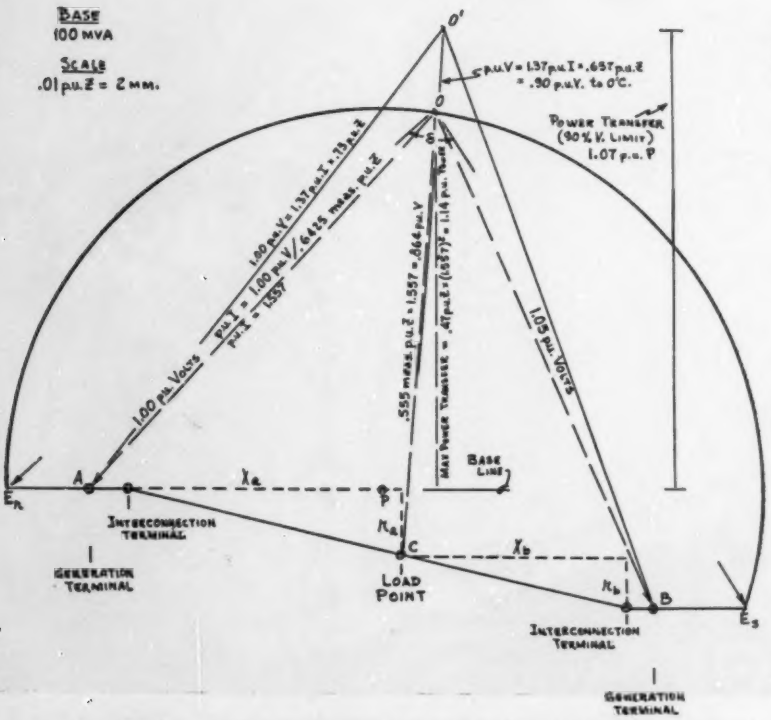


Fig. 5—A graphical analysis such as this can be used to obtain voltage at interconnection load points for specified amounts of power flow across the interconnection. Information derived from circle diagram is for condition of maximum power transfer as limited by steady state stability.

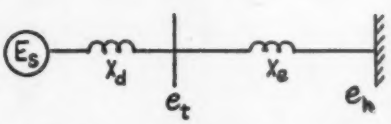


Fig. 6—This is the transmission system used to discuss generator terminal voltage and steady state stability.

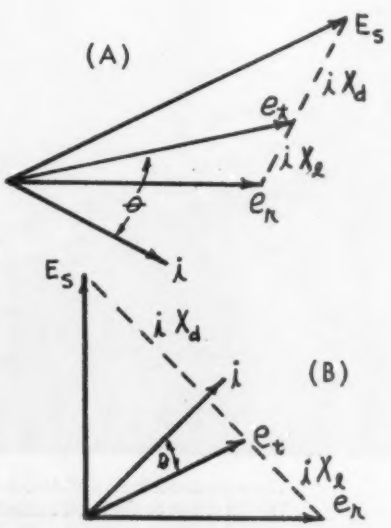


Fig. 7—"A" and "B" show the initial and "pullout" states of operation.

points are not the limiting factor, either by design or choice, it is of interest to determine the voltages which will occur when maximum power flows over the interconnection to the receiving system.

Busses of known constant voltage are of interest mainly to obtain relative measures from the proportionality of other voltages in the system, if the method of analysis is graphical, or to compute unknown elements of the system if a mathematical method of analysis is to be used. A graphical method of tie line analysis making use of known values of terminal voltage is discussed below.

A voltage back of the equivalent generator synchronous reactance at the sending and receiving ends of the system yields the exciting current for the excitation necessary to sustain the regulated terminal voltage for the power transferred between systems.

Determination of the angle between voltages back of the equivalent system reactance at the sending and receiving ends is a measure of the nearness of the power transfer to the steady state stability limit.

This application of a graphical analysis is to obtain voltage at interconnection load points for specified amounts of power flow across the interconnection. Conversely, when minimum allowable voltage is given for the load point, the power flow producing the voltage will be determined.

Graphical analysis

Drawing the system impedance network is the first step in the graphical preparation. Because the power transfer is a function of the impedance between the sending and receiving systems, the network will consist of the transfer impedance between these two points. Line terminals of importance between the sending and receiving internal voltage points are represented as real in the network.

These include (1) the point within the sending end equivalent nearest the interconnection terminal where voltage is held constant, (2) the sending end terminal of the interconnection, (3) the intermediate load point on the interconnection, (4) the receiving terminal of the interconnection, (5) the point within the receiving end equivalent nearest the interconnection terminal where voltage is held at a constant value.

The following steps describe the construction of the diagram shown in Figure 5:

(1) Select an appropriate scale for the measurement of R and X, draw the impedance network keeping the reactance on the horizontal and the resistance at right angles to the reactance.

(2) Draw a semicircle whose center is on a horizontal base line that coincides with the equivalent receiving end reactance. The location of the circle's center and the selection of its radius should cause the arc to pass thru the extreme ends of the network.

(3) A point—O—is selected on the circle so that the measured lengths of O-A and O-B are directly proportional to the actual voltages at these points. It is noticed that A and B are locations on the transmission system where voltage is held constant.

(4) Measure O-A and convert the length to the scale impedance. Since O-A represents the vector voltage at the receiving generator terminals, the unit current of the diagram can be computed by dividing the voltage by the measured impedance.

(5) Vertical measurements on the diagram represent the resistive component of impedance. The scale resistance multiplied by the diagram's unit current squared gives system real power. Horizontal measurements on the diagram represent reactive impedance. The scale reactance multiplied by the diagram's unit current squared gives system reactive power flows.

Information derived from the circle diagram is for the condition of maximum power transfer as limited by steady state stability. The component of power measured from point O to the horizontal base line is the transfer across the system.

The component of power measured vertically from the horizontal base line to the horizontal of the sending end system is the system power loss. Real and reactive components of power can be obtained at any point on the system by drawing a vector from point O to the terminal of interest, measuring the vector to the impedance scale, and multiplying by unit current squared.

Note that the reactive is measured from the unity power factor point where the vertical thru point O intersects the horizontal component of kva.

(Continued on page 113)

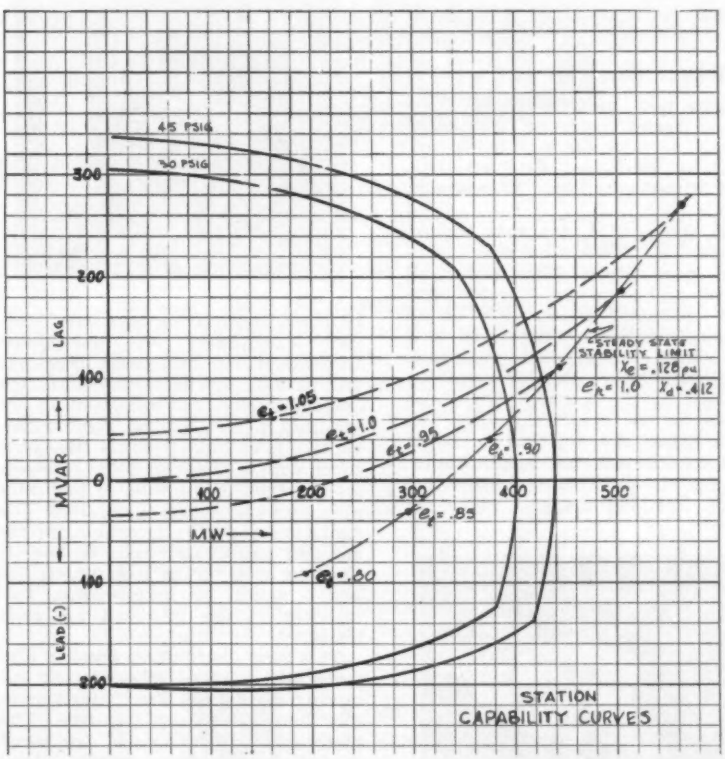


Fig. 8—These station stability curves are for underexcited operation of station generators at various assumed values of terminal voltage.

New utility equipment

Allis-Chalmers transformer

Introduction of a new line of low-profile, single-phase, surface-mounted residential transformers, type SMRT, has been announced by Allis-Chalmers Manufacturing Co., 938 S. 70th St., Milwaukee 1, Wis.

The new lightweight transformer is engineered for complete safety and installation, operation, and maintenance ease. It is available in sizes 25 through 50 kva, 15 kv and below, with a 240/120 secondary rating. Its high voltage interrupter switch is capable of interrupting full load current.

One third smaller and lighter than existing units, the 50-kva residential transformer weighs only 750 pounds complete. Its one-size 28½-inch high tank and removable cable compartment accomodates all kva and voltage combinations. The transformer occupies a scant three-foot square area.

The transformer's entire cable compartment can be removed for

easy cable installation and maintenance. Its compartment is completely tamperproof.

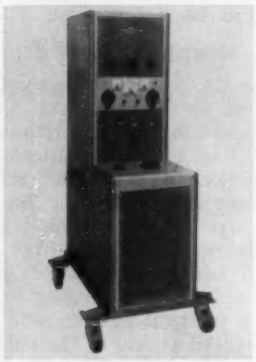
Write U-801 on reply card, pg. 17

Knopp transformer testers

Now available from Knopp, Inc., 1307 66th St., Oakland 8, Calif., is the new Uniload current transformer testing equipment, type GCT-1, with 34 ranges from five to 6,000 amperes and designed for the testing of instrument transformers.

It is a complete testing facility and offers great convenience and safety as well as unusual speed where accurate measurement of the current over a wide range is needed.

The equipment contains a heavy-duty current-loading transformer, a



high-accuracy precision multirange current transformer standard, built-in ASA standard burdens, and a panel-mounted transformer comparator for reading the ratio error and phase angle of the transformer under test directly from dials.

The equipment also includes a variable-transformer current control, switches, overload protection, etc., all housed in a modern console cabinet. All controls and measuring devices are conveniently located for ease of operation.

Write U-802 on reply card, pg. 17

Tel-E-Lect derricks

Three new models of the Commander series hydraulic, continuous rotating derricks are now being produced by Tel-E-Lect Products, Inc., 10001 Minnetonka Blvd., Minneapolis, Minn.

The model RM, for rear mount, features a derrick-mounted command post which incorporates all controls and gives the operator complete command of the job in all working positions. Unique in new style body design and over-rear-wheel installation, the RM combines the best of the derrick, body, and chassis for the greatest possible use.

The model SM, for side mount, is designed for fast and easy installation to standard line construction bodies. The SM derrick, which in-

cludes the rear platform and stabilizer jacks, mounts on either the street or curb side at the rear of the chassis. The hydraulic control panel may be installed at the operator's convenience, either on or opposite the tower or within the body.

The model CM, for center mount, allows excellent side workability with large rear platforms and long overhangs. Identical right and left controls are mounted on both the street and curb sides of the derrick.

All the Commander series derricks feature complete hydraulic control and drive systems plus 360 degrees continuous rotation.

Write U-803 on reply card, pg. 17

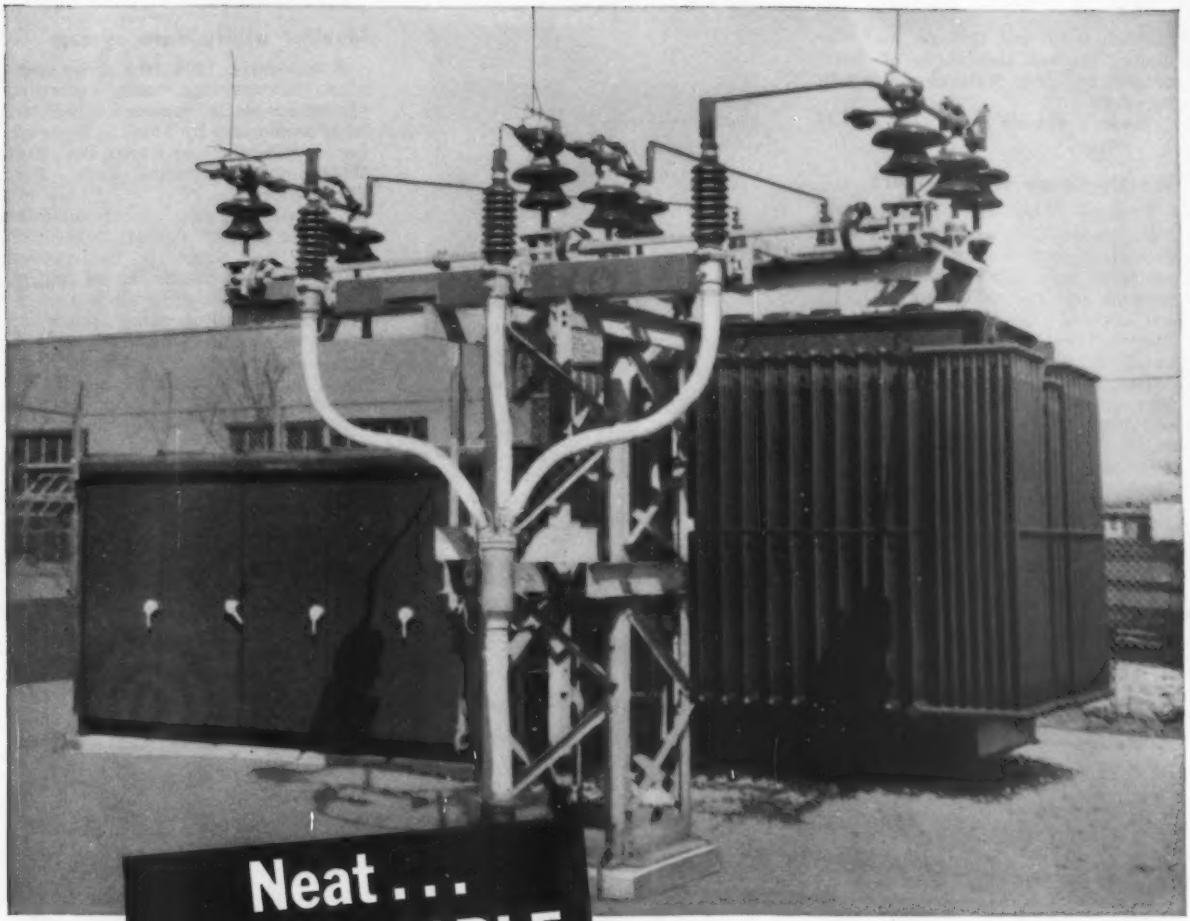
I-T-E power circuit breaker

The I-T-E Power Circuit Breaker Div., 1667 N. Main St., Los Angeles 12, Calif., has just announced a new Trend-Line 14.4-23-kv, 100-500-mva breaker offering high performance, five-cycle arc interruption, reduced maintenance, and a small, compact "package."

At the heart of this new breaker design are I-T-E's unique Kool-Arc interrupters, heretofore available on-

ly in subtransmission breakers. Kool-Arc interrupters are test-proved throughout their full range of ratings and provide shorter arcing time, less contact erosion, and minimum oil deterioration. In addition, these interrupters have high-strength fiberglass tubes with all internal parts mechanically keyed to the tube so that only a single locking ring is required. The contacts are easily accessible for inspection and maintenance by loosening four bolts on the interrupter. For added safety in performance, two interrupters are provided for each phase.

This new distribution breaker also features a unique spring electric operating mechanism that is mechanically and electrically trip-free. The mechanism utilizes a set of two heavy guided compression springs. Low current requirements, full power manual closing, high-speed operation,



Neat . . . and RELIABLE

This industrial transformer load-center was installed in minimum time, requires little space, and presents an exceptionally neat appearance, largely because circuits were brought in underground and there are no overhead wires and few structures.

Standard G&W "ST-Sodertite" Potheads were used to terminate the 34.5-kv primary supply to this transformer station for long-time reliability. Type "ST" Potheads are permanently sealed at the factory by metal-to-porcelain soldered joints thus reducing the number of field operations necessary to seal the pothead against weather. Semi-conducting glaze on the porcelain between bottom petticoat and wiping sleeve controls longitudinal dielectric stresses of the cable termination. Extra internal creepage distance provided by closed hood and simple ferrule design further enhance reliability. Spun copper wiping sleeve and hood eliminate possibility of porosity, assuring maximum protection.

Get all the facts about standard G&W "ST-Sodertite" Potheads from your G&W representative or by writing for Bulletin AA56.

G & W ELECTRIC SPECIALTY COMPANY

3524 WEST 127th STREET • BLUE ISLAND, ILLINOIS

CANADIAN MFR. • POWERLITE DEVICES LTD. • TORONTO, MONTREAL & VANCOUVER

superior quality standards — inspired specialized design

A-61-2

For more details on above items, use reply card on page 17

individual lift-rod linkage, and adequate internal clearances of interrupters are other features of this new breaker.

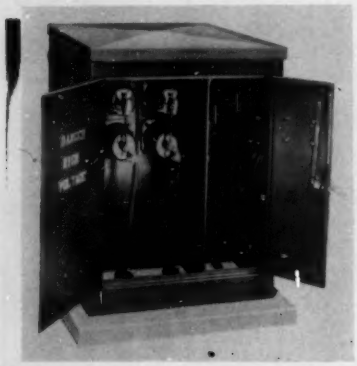
Write U-804 on reply card, pg. 17

Westinghouse transformers

Primary service pad-mounted transformers (PSP) designed for residential underground distribution on grounded wye loop or dual-feed systems in primary voltage up to 15 kv are offered by the Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

The complete package of transformation protection and switching equipment is available in single-phase units, ten to 167 kva.

In spite of the many advantages



of underground systems for residential distribution, a major deterrent to the widespread use by electric utilities has been the many new problems of installation and operation experienced with this type of service. These problems have been solved through standardization and simplified construction, plus new and optional features.

For example, the PSP unit consists of three main components: a transformer compartment, a detachable high- and low-voltage terminal compartment, and a removable cover that provides complete isolation of all electrical connections and tank hardware.

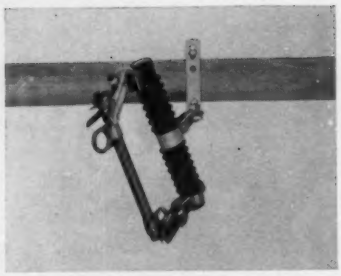
Write U-805 on reply card, pg. 17

L-M economy open cutouts

New open cutouts designed for economy are being offered by Line Material Industries, McGraw-Edison Co., 700 W. Michigan St., Milwaukee 1, Wis.

Designated type EDO, these cutouts are rated 100-amperes continuous current at voltages of 7.8 and 15 kv and meet NEMA distribution cutout voltage withstand requirements.

Type EDO cutouts will interrupt full range of fault currents from slight overloads to interrupting ratings of 3,000 amperes at 7.8 kv and 2,000 amperes at 15 kv.



The new cutout, supplementing present LMO and HDO types, has been designed specifically to fulfill requests of many operating companies for economical overcurrent protection for low fault capacity systems. Thorough testing assures proved performance over the range of fault currents for which the EDO has been designed.

Features that afford dependable operation are small, compact construction; fully birdproofed attachments; and non-ferrous current carrying parts.

Write U-806 on reply card, pg. 17

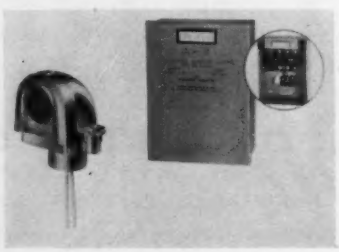
Fisher-Pierce control series

A new control series by Fisher-Pierce Div., Sigma Instruments, Inc., 170 Pearl St., S. Braintree 85, Mass., offers completely automatic control of sign lighting or general illumination, plus a provision for manual switching, with no resetting needed.

The control dependably turns lights on when natural light fades to a certain intensity level, and turns them off when natural light reappears at dawn. In addition, lights may be turned off manually at any time—at the close of the business day, for example—by pressing a button on the control box. The lights will remain off until the next evening, when the control will automatically "remember" to turn the lights on. Lights can also be turned on during the daytime by pressing another button.

Series 6820 controls are designed for any lighting application in which it is desirable to add direct manual control to completely automatic photoelectric control. They may be used to control outdoor sign lighting or general illumination (mercury vapor, fluorescent, or incandescent) in filling stations, farm buildings, driveins; on loading platforms and in other work areas.

Write U-807 on reply card, pg. 17



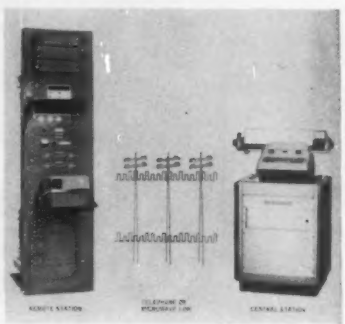
Monitor utility data system

A new series 7000 data alarm scanning, telemetering, and recording system for electric power utilities has been announced by Monitor Systems, Inc., a subsidiary of Epsco, Inc., Fort Washington Industrial Park, Fort Washington, Pa.

The new system is of modular "building block" design throughout and utilizes standard field-proven components for maximum reliability, economy, and expandability.

The system automatically scans and measures voltages, demand, wattage, var, and temperature quantities from potential transformers, punch type demand meters, thermoverters, and thermohm units located at remote substations, converts this information into digital form, and telemeters it to a central control station where it is recorded by electric typewriter on preprinted log sheets.

On automatic operation, measurement and transmission of data is initiated in a predetermined sequence by a digital timing clock. Measurement and transmission may be initiated manually at any time from either the central recording station, or from



any of the remote substations. After digitally logging real time, the series 7000 system automatically checks itself by means of a standard input signal stable to plus or minus 0.05 per cent.

Any failure of the telemetering system at the transmitting point, or failure of a leased line channel, results in a continuous alarm at the central recording station.

Write U-808 on reply card, pg. 17

MoPeCo ventilator-heater

A new ventilating heater for manhole and other underground use with a detachable 800-watt a-c generator is now in full production at the Morrison-Pelsue Co., 2001 S. Bannock St., Denver 23, Colo.

The MoPeCo model PE-G 800 is a 117-pound portable ventilator and heater with attached 800-watt, 115-volt, 60-cycle a-c belt-driven generator for electric light, high level warning signals, or soldering iron and small power tools. Four outlets on the generator permit several accessories to be used at one time. Round-

ALLIS-CHALMERS

A-1463

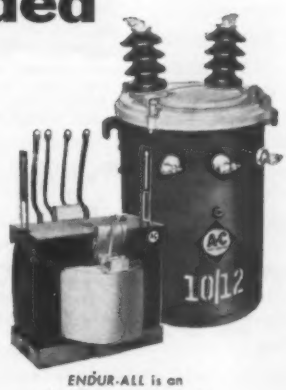
32 parts no longer needed

. . . 32 potential trouble-makers eliminated!

New locked core-and-coil end-frame construction eliminates 32 nuts, bolts and washers! Nothing to loosen . . . no welds to break. Unique A-C locking straps assure uniform high compression for *greater short-circuit strength.* And more duct area is exposed for *more* efficient cooling.

These additional A-C enduring values give you more for your ENDUR-ALL transformer dollar: New overload capabilities with new high-temperature oil and new high-temperature insulation • impedance is reduced as much as 25% — allows full utilization of the greater overload capacity • units are 10% lower, 10% lighter for easier hanging • new high-gloss-retention paint features 3 baked-on coats • new nonaging, reusable gasketing.

Call your nearby A-C office for more ENDUR-ALL *transformer facts or write* **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*

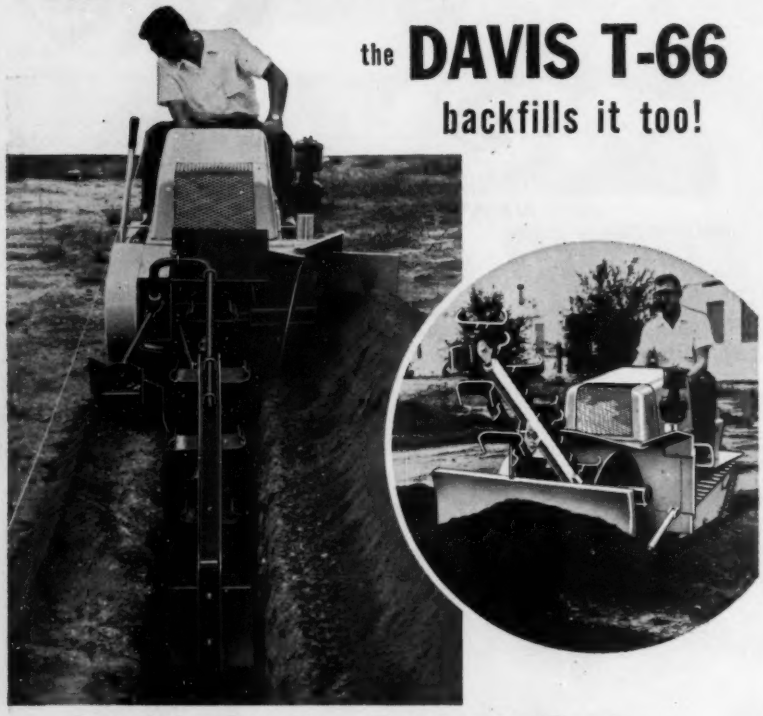


ENDUR-ALL is an Allis-Chalmers trademark.

For more details on above items, use reply card on page 17

Digging the ditch is only half the job...

the DAVIS T-66 backfills it too!



Coast to Coast... Border to Border... and in many foreign countries Owners Acclaim the T-66!

When you've dug a trench you're only half done; you have to backfill it, too! Only the Davis T-66 does the whole job, and does it with profit-making performance — because it is **designed** as a trencher and a backfiller. Just ask any user. Large track shoes, a unique hydraulic drive, and the T-66's extra-heavy 1400-lb. weight give ground-gripping traction for accurate ditching control and backfilling power. No erratic rubber-tire bounce. Hydraulic boom lets you have absolute control over digging depth as well as backfill blade. Instant Forward/Reverse provides unmatched maneuverability for backfilling. It digs 4" wide to **66" deep**, or **12" wide**, 30" deep, and at varying widths and depths in between. Attachments available for trenches **16" wide**, 24" deep and **flush** alongside walls or fences. You can buy with confidence because the T-66 is built to withstand the severest tests, and is produced by men who are leaders in the design of digging equipment.

the DAVIS HUSTLER UTILITY TRAILER

This 2000-lb. capacity, tilt-bed trailer for the T-66 and other loads has low center-of-gravity stability and load equalization suspension system. Sides optional.

the DAVIS PUP TRENCHER
Self-Propelled

Digs by itself. This self-propelled trencher is driven by a six-speed winch mechanism. A productive tool for trenches 2"-3" wide to 36" deep, or 4" wide, 18" deep.

We Welcome Competitive Demonstrations!

The performance of the T-66 creates confidence that invites comparison so you know why it is the standard bearer of trencher value. Ask about its 90-day unconditional guarantee!

DAVIS MFG. INC.
1524 S. McLean Blvd., Wichita 13, Kan.

Please send me description T-66 literature and the name of my DAVIS dealer____. I am also interested in the Davis Pup____ Davis Hustler____

NAME_____

ADDRESS_____

TOWN_____ STATE_____

D2-261

ed carrying handles protect both equipment and personnel.

The Briggs & Stratton engine is equipped with a propane carburetor. The new ventilator-heater delivers from 300 to 800 cubic feet of air per minute. Heated air is forced over a stainless steel heat exchanger. All products of combustion pass into the atmosphere through the burner exhaust so that only fresh, heated air is forced into the manhole area.

The unit is equipped with a forced draft burner which has an input rating of from 10,000 to 45,000 Btu's per minute with a 98-degree temperature rise. It is designed for year-round ventilation, delivering heated fresh air in winter and fresh air only in summer when operated as a blower.

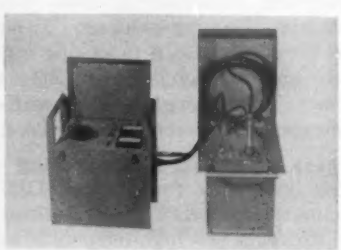
Write U-809 on reply card, pg. 17

Davenport cable testing unit

A new line of equipment for quicker and safer underground cable testing and fault locating by power company crews is designed around a high-voltage portable power supply unit made by Davenport Manufacturing Div., Duncan Electric Co., Inc., Dept. EU-2, 2530 N. Elston Ave., Chicago 47, Ill.

The testing methods made possible by this improved type of equipment not only reduce the hazards of working around energized cables, but substantially cut the time required for most fault locating jobs.

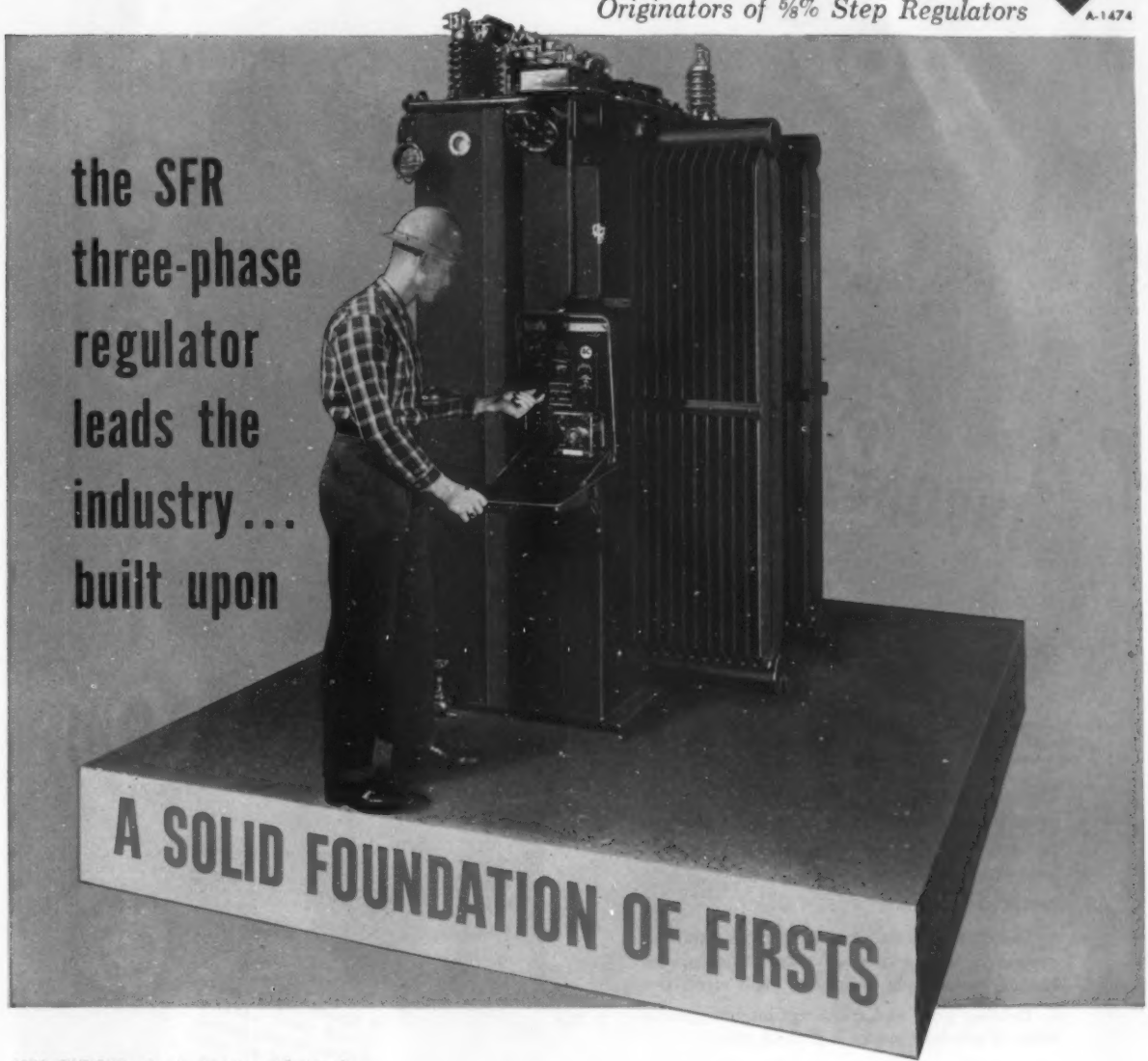
Designated as model XVD400-35-10C, the unit comes in two sections each weighing about 115 pounds. It provides 0-45 kv d-c at maximum current of 35 ma or 0-30 kv d-c at 50 ma. This range permits use for cable proof testing, cable fault lo-



ALLIS-CHALMERS

Originators of 5/8% Step Regulators

A-1474



1960 FIRST short-circuit withstand of 40 times Vari-Amp current

1959 FIRST standard electrical drag-hand reset

1958 FIRST with Caliband control

1952 FIRST frictionless voltage-regulation relay

1940 FIRST Vari-Amp feature

1939 FIRST unit construction

1938 FIRST unidirectional breather

1935 FIRST voltage integrating time delay

1933 FIRST ⅝% step regulator

"Firsts" are important—they signify the extensive research, development and leadership at Allis-Chalmers. This program gives you the SFR regulator with its *33% saving in space . . . 30% lower cost per kva . . . 20% less weight.* And continuing research and development provides these additional SFR benefits:

78 fewer bolted connections, faster untanking and testing, all connections in full view—thanks to unit construction.

Fast, accurate control settings—assured by exclusive *Caliband* control.

Oil deterioration reduced—moisture and combustible gases eliminated by the unidirectional breather.

Operation at greater-than-nameplate current when range of regulation is reduced, with *Vari-Amp* position indicator.

Positive series winding protection, by externally mounted regulator by-pass arresters.

These are only a few of a number of benefits you get with Allis-Chalmers SFR feeder voltage regulators. For all the facts — call, wire or write your nearby **Allis-Chalmers** office.

Caliband and Vari-Amp are Allis-Chalmers trademarks.

For more details on above items, use reply card on page 17

DEEP DEEP GROUNDING

INSURES EXTRA PROTECTION

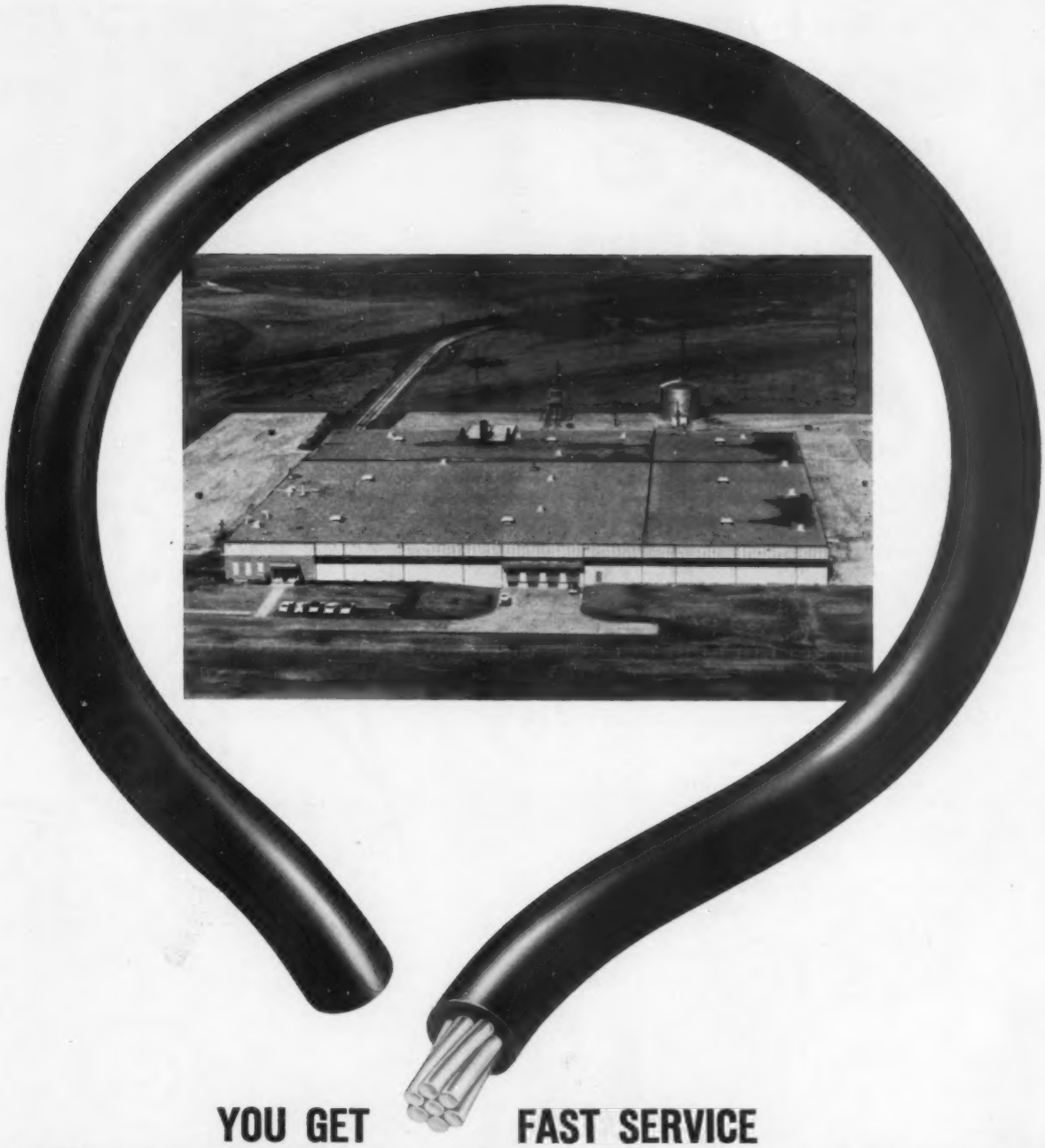
• Heat treated, alloy steel driving stud resists mushrooming — can be used over and over. Couplings of rugged Silicon Bronze.
• Completely machined point speeds driving. All rod sections are threaded on both ends for use as top, intermediate or bottom section.
BLACKBURN
Sectional
COPPER BONDED
GROUND RODS
Permanently Moist Soil

Blackburn Sectional Rods Get Down Into The Permanently Moist Soil

Drive down to permanently moist soil that gives lower earth to rod resistance. Actual experience shows a few dollars invested in deep grounding has saved thousands of dollars in overhead burn-outs.

- **BLACKBURN Sectional Rods have a uniform coating of highly conductive corrosion-resistant copper, molecularly bonded to *rigid steel core.***
- **Driving studs and couplings interchangeable with all standard sectional ground rods.**
- **Available through Electrical Distributors.**

JASPER BLACKBURN CORPORATION
1525 Woodson Rd., St. Louis 14, Mo.
WYdown 3-9430



YOU GET FAST SERVICE IN THE SOUTH FROM THIS ANACONDA WIRE & CABLE PLANT

The Anaconda Wire & Cable Plant at Watkinsville, Ga., only 60 miles from Atlanta, is right in the heart of the South's dynamic economic action areas—where it can serve you best.

You get faster, more convenient service . . . because Anaconda is right next door.

You get complete service . . . because the Watkinsville manufacturing and storage facilities are designed to fill the specific needs of Southern Industry with a complete line of wire and cable.

And always, Anaconda's entire research and engineering facilities, the most complete in the industry, assure the high quality of the Anaconda product and stand ready to help you.

Give the Man from Anaconda a call. Sales Offices are located in Charlotte, Atlanta, Birmingham, New Orleans and Tampa. 61372

ASK THE MAN FROM

ANACONDA®

COPPER AND ALUMINUM WIRE AND CABLE

For more details on above items, use reply card on page 17

Now In The

SOUTH

Holan Team To Help Utilities Launch Live Line Bare-Hand Method

A special Holan team will start a follow-up tour of Southern utilities next month to present more detailed information on the live line bare-hand technique of working on live high-voltage lines.

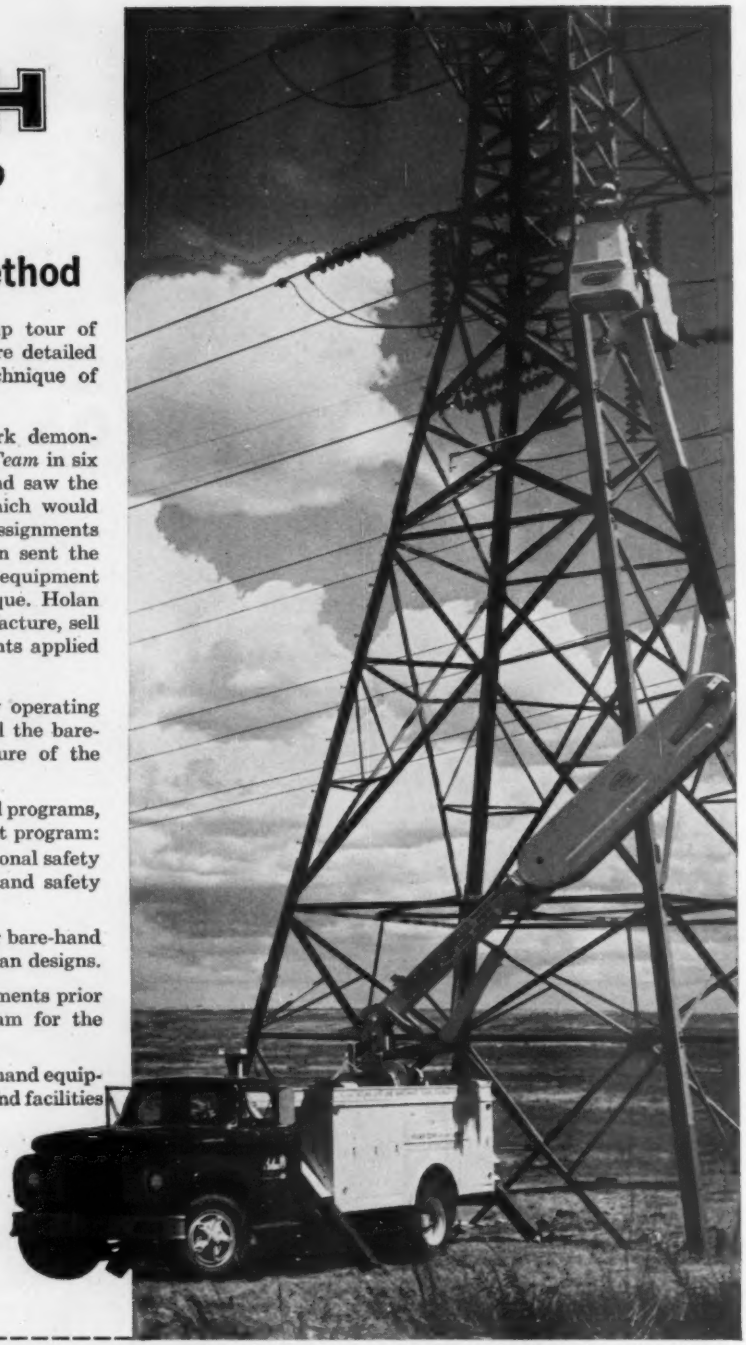
Nearly 350 utility executives witnessed work demonstrations of the *Holan Live Line Bare-Hand Team* in six locations during a recent two-week period and saw the team slash 122 manhours from the time which would have been needed to perform the six work assignments by conventional methods. Holan Corporation sent the team into the field April 1 after pioneering the equipment used in the development of the new technique. Holan has been granted the exclusive right to manufacture, sell and license the special metal shielding (patents applied for) used in the bare-hand method.

The Holan follow-up tour will enable utility operating and executive committees to discuss in detail the bare-hand method, its applications and the future of the program.

To help utilities launch their live line bare-hand programs, Holan representatives will offer this four-point program:

1. Coordinate the efforts of utilities and national safety groups in setting new work procedures and safety regulations.
2. Solicit utility equipment requirements for bare-hand work and incorporate them in future Holan designs.
3. Obtain utility personnel training requirements prior to establishing a Holan training program for the bare-hand concept.
4. Help establish testing standards for bare-hand equipment and make available Holan services and facilities for determining standards.

We are interested in your future bare-hand program and would welcome the opportunity to discuss the revolutionary new concept. Just fill in and mail the coupon and we will make the necessary arrangements.



Holan's Live Line Bare-Hand Team cut 26 manhours from the time needed to replace a jumper at this 134-kv dead-end tower that had become too tight during a conductor re-sagging program. The Holan team — now on a coast-to-coast tour — is proving daily that tremendous time savings are possible through the use of the bare-hand method of working on energized high-voltage lines.

HOLAN CORPORATION OF GEORGIA
Everee Inn Road, Griffin, Georgia

We would like to discuss the Holan Live Line Bare-Hand technique.

Name_____ Title_____

Company_____

Street_____

City_____ Zone____ State_____

Holan Corporation, 4100 West 150th St., Cleveland 35, Ohio

Holan

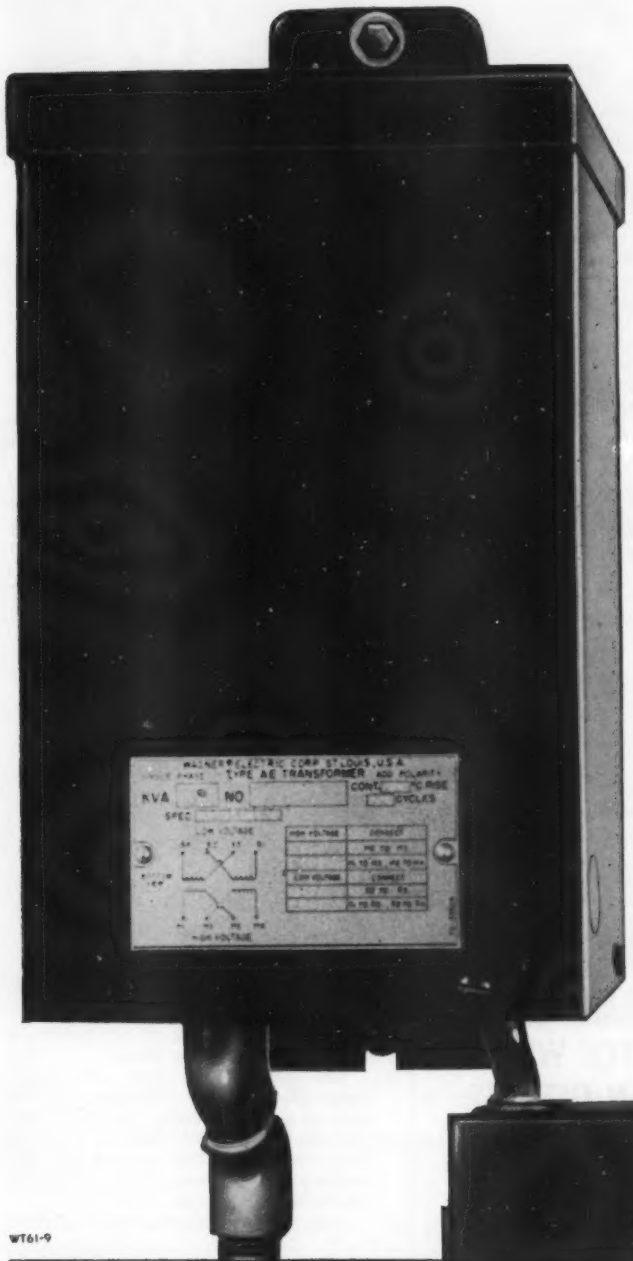
Subsidiary of THE OHIO BRASS COMPANY

HOLAN

WAGNER® DRY-TYPE GENERAL PURPOSE TRANSFORMERS

Compact Epoxy-Filled Units that

WHISPER WHILE THEY WORK



Unusually small in size (the 10 kva rating is less than a foot-and-a-half high), Wagner® totally-enclosed Type AE Single Phase Transformers can be used for general purpose applications. They have a low sound level, the result of encasing small Wagner Form W core and coils in a solid block of epoxy compound . . . to give you a whisper-quiet transformer that can be used anywhere noise would be a nuisance.

Available in ratings from 1 to 10 kva, Wagner Type AE Transformers have insulation protection suitable for continuous operation at 80°C in a 30°C average ambient. All parts are sealed from dust, moisture, and corrosion by the epoxy compound. Every unit is built to conform to all applicable standards of ASA and NEMA.

Wagner Type AE Transformers can be installed indoors or out in any location where they will not be submerged or exposed to injurious fumes in concentration. Compact and lightweight, they require no fireproof vaults and can be mounted indoors in any position, at any angle, on wall, floor, or ceiling. These transformers are carried in stock at Wagner branches and distributors. There's one near you, listed in your 'phone book. Call or write now.

Wagner Electric Corporation
6440 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.

WT61-9

SPECIFICATIONS

Type AE—Single Phase—1 to 10 Kva 80° C Rise, 60 Cycles.

High Voltages: 120 x 240; 240 x 480; 600 volts, no taps; 480, 600 volts, 2—5% taps below normal.

Low Voltage: 120/240 volts.

KVA	DIMENSIONS IN INCHES			NET WEIGHT POUNDS	AVERAGE SOUND LEVEL DECIBELS
	Height	Width	Depth		
1	10 13/16	6 5/16	6 5/16	28	37
1½	11 13/16	6 5/16	6 5/16	34	38
2	13 1/8	6 13/16	7 3/16	46	38
3	14 1/8	6 13/16	7 3/16	62	39
5	15 5/16	9 3/16	9 1/4	93	39
7½	16 1/16	9 11/16	10 3/16	130	39
10	17 1/8	11 1/8	10 1/4	167	39

For more details on above items, use reply card on page 17

cating, fault reduction by burning, and fault locating with a high voltage Murray loop.

Write U-810 on reply card, pg. 17

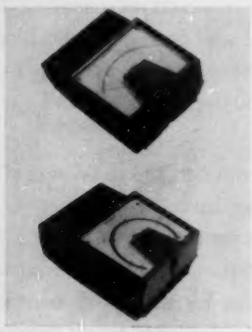
Westinghouse instruments

Portable a-c and d-c ammeters and voltmeters that feature taut-band suspension frictionless mechanisms are now offered by the Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

The moving element of the taut-band suspension system is suspended between bands of high-strength metal ribbon which are supported on springs at each end. Since friction is eliminated, there is no wear between moving parts and maintenance is greatly reduced. Also, these portable instruments can withstand much rougher handling since there are no delicate pivots or jewels to crack and wear.

Scale lengths are six and 10½ inches, respectively, with corresponding scale arcs of 100 and 240 degrees. The attractive two-tone gray case features an insulated retractable handle.

Write U-811 on reply card, pg. 17



Fiberglass aerial boom

A new all fiberglass boom, described as being of a specific design and subject to stringent quality control, is now available on Skyworker aerial lifts, from Hughes-Keenan Div., U. S. Air Conditioning Corp., P. O. Box 360, Delaware, Ohio.

The boom construction is of high modulus woven roving cloth impregnated with self-extinguishing polyester resin.

At the work platform or outer end of the boom, bearings and idler sheaves are nylon, thereby eliminating any need for greasing and any possibility of dirt contamination. The drive sheave at the leveling system is protected at wear surfaces by dry lubrication, while a fiberglass shaft and a reduction of the number of metallic parts in the area of the work platform make possible the maximum possible flashover gap.

Hoses for the remote control system at the work platform are Polypenco Nylaflow flexible pressure hose, and tubes of the upper boom are high pressure plastic.

The internal leveling system is supplied with a fiberglass rod assembly providing 102 inches of non-metallic construction from the work platform to the knuckle joint.

A unique "spade-end" contour of the boom at the outer end permits embedding within the housing portion of the boom all sheaves, bearings, and other mechanisms necessary for completely safe operation.

Write U-812 on reply card, pg. 17

Knopp loading transformers

A greatly improved loading transformer, type CL-6, is announced by Knopp, Inc., 1307-66th St., Oakland 8, Calif.

It is of five-kva capacity and may be used continuously at that output on 110- and 220-volt connections, 50/60 cycles.

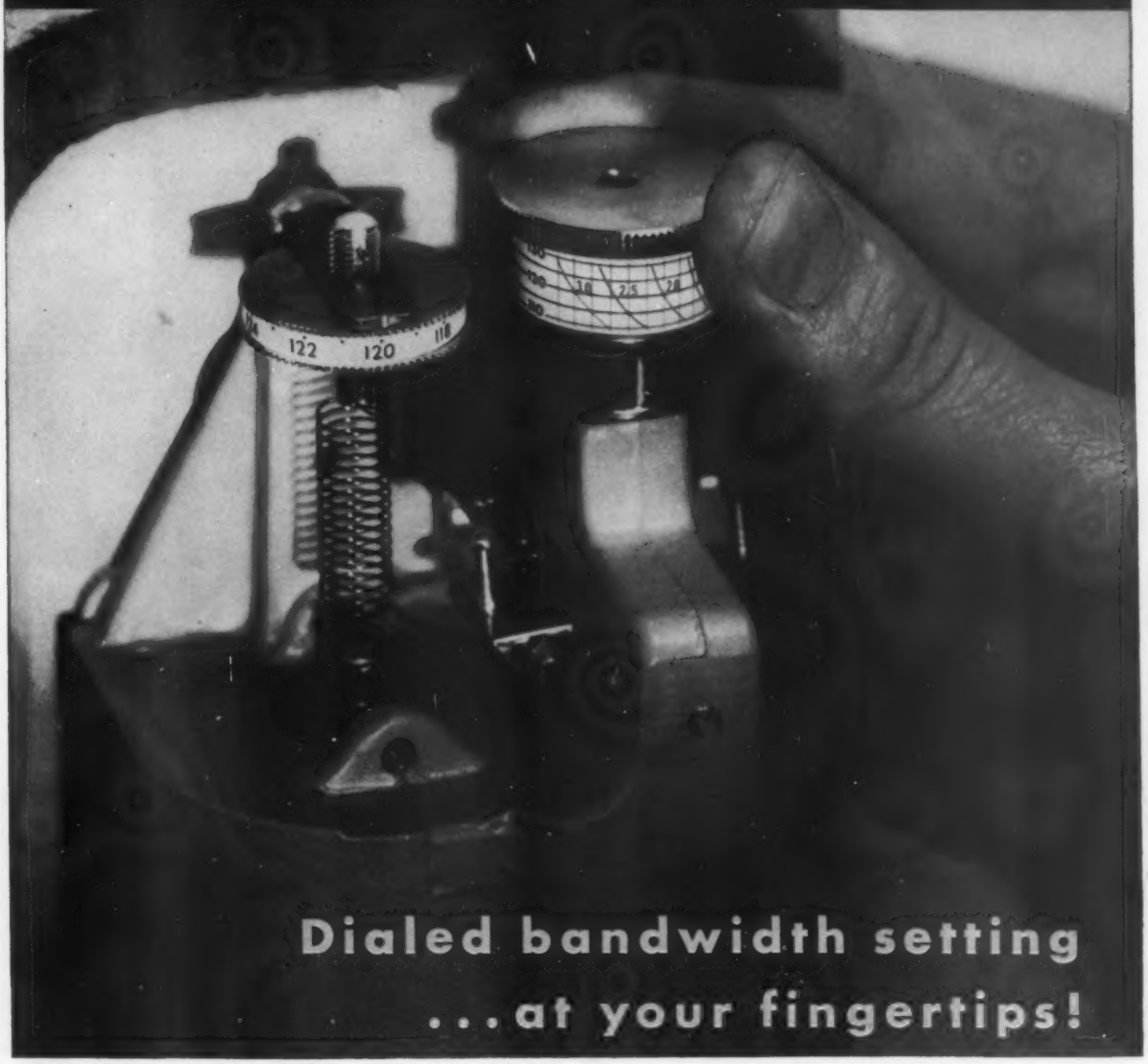
Input taps on the transformer are provided for 90, 110, 180, and 220 volts. The output currents are five volts, 1,000 amperes or ten volts, 500 amperes, continuous duty.

On intermittent duty the output currents may be increased to 750 amperes at ten volts and 1,500 amperes at five volts on a 40 per cent duty cycle. Both the primary and secondary are insulated for a 4,000-volt, 60-cycle one-minute test.

The loading transformer, weighing

Some "Compact Trenchers" have Features Ditch Witch doesn't have!
It's true! Ditch Witch cannot boast such features as muscle power, operator harness, wind-up lines, or whiffle-trees. Maybe it is because we have never been able to see how this could result in a good trencher.
DITCH WITCH TRENCHER
ALL THE C4 DITCH WITCH CAN OFFER IS:
MORE HORSEPOWER (7 H.P.)
MORE DIG-POWER
SELF-PROPELLED MOBILITY
TOP PERFORMANCE
HEAVIER CONSTRUCTION
LOW-COST MAINTENANCE
LONGER LIFE
MAXIMUM ECONOMY
Of course, that seems to be what a lot of people want!
CHARLES
Machine Works, Inc.
CALL COLLECT: FE 6-4404
633 BIRCH ST. • PERRY, OKLA.
Self-propelled 7 HP Ditch Witch C4 trenches 3" to 6" wide, depths to 2'

ANOTHER STEP AHEAD IN VOLTAGE REGULATION



Dialed bandwidth setting ...at your fingertips!

G-E Micro-Band* relay: first to permit fast, accurate setting of both regulator voltage level and bandwidth

Now, with General Electric single- and three-phase step voltage regulators, you can dial optimum voltage level *and* bandwidth *in seconds . . . with micrometer accuracy!*

This important new advantage results from G.E.'s Micro-Band voltage-regulating relay—the first in the industry to offer you a dialed calibration of *both* these vital adjustments.

Micro-Band relay saves you time and money by eliminating the guesswork and painstaking procedures normally involved in making regulator adjustments. What's more, this *full* calibration permits precise coordination of voltage level and bandwidth setting with General Electric's highly flexible time-delay control. Thus, you take full advantage of the reduced bandwidths possible with General Electric regulators—bandwidths proven by recent computer studies to offer you increased system earnings at no sacrifice of regulator life.

Your General Electric regulator representative has complete information on the new Micro-Band relay and can show you how to achieve system savings through reduced regulator bandwidths. Call him today. Or write General Electric Company, Section 456-08, Schenectady 5, N. Y. *Voltage Regulator Products Section, Pittsfield, Mass.*

* Trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more details on above items, use reply card on page 17

Protect electrical cables from corrosion with J-M Transite Conduits

Corrosion is no problem to underground electrical systems protected by Johns-Manville Transite® Conduits. And, these ducts won't rust or rot and they resist electrolytic action.

Made of inorganic and virtually indestructible asbestos and cement, non-metallic Transite is immune to most acids, alkalis, aromatics and aliphatics found in soils around industrial areas. Specifically, it resists benzine, kerosene, oils, greases and tars. Further, Transite is non-combustible and is unaffected by high thermal stresses from cable overloads, faults or burn-offs. You design with confidence when Transite is the conduit chosen for cable protection.

For full details send for Data Sheets 2-477143. Write Johns-Manville, Box 362, ES-8, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable address: Johnmanvil.

JOHNS-MANVILLE JM PRODUCTS

but 60 pounds, can be widely used for testing and calibrating current-actuated protective and switching devices, current-carrying apparatus, and transformers.

Write U-813 on reply card, pg. 17

G-E regulating relay

A new regulating relay, called Micro-Band, which allows bandwidths of ± ¾ of a volt, is now available on regulators from General Electric Co., Voltage Regulator Product Section, Pittsfield, Mass.

Bandwidths of ± ¾ of a volt, while known to be advantageous from the standpoint of feeder revenue through increased line length or capacity, have not always been available because of difficulties encountered in field adjustment.

Voltage level and bandwidth settings on G-E single- and three-phase step regulators can now be achieved by dialing each to the desired levels.

The calibrations are easily visible and settings, once made, remain locked in position.

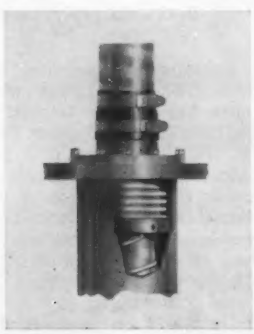
This feature is being added to G-E's line of single- and three-phase step-voltage regulators at no increase in price.

Write U-814 on reply card, pg. 17

Anaconda cable end seal

An end seal for pipe type cables that allows for the expansion and contraction of the cable has been introduced by Anaconda Wire and Cable Co., Hastings-on-Hudson, N. Y.

Advantage of the device is that it does not require excessive pres-



with Sangamo Dual Range Mechanical Demand Registers

Sangamo DR registers improve metering accuracy, keep pace with load growth, reduce register change-outs, and cut inventory costs by reducing the number of meters and registers you need to stock.

The Sangamo dual range (DR) mechanical register has a "flip-over" scale plate that permits rapid in-the-field range changes while assuring positive interlock between scale and range selected. It is available for singlephase and polyphase watthour meters in both universal and standard scales.

A range change is accomplished by simply loosening (not removing) six screws and reversing the scale plate. Only one gear moves, and the register does not require readjustment after the change - - - accuracy is always ±1% of full scale. Polished, hardened stainless steel pivots and jeweled bearings maintain the high accuracy.

And in the DR, you can rely upon the Type H slow speed, high torque motor to remain trouble free. Sangamo's gravity reset action further assures dependable, maintenance-free performance. Your Sangamo Representative has other important information about the DR.

PW61-6

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

sure against the cable which might damage cable insulation. At the same time, the oil seal is not disrupted by cable movements.

The end closure, or flexible barrier, has application to semi-stop joints and potheads on high pressure, oil-filled, pipe type systems. Installations are already in use.

A bellows type device relieves strain on the cable connection and helps eliminate damage to paper cable resulting when conventional connecting devices are screwed down too tightly.

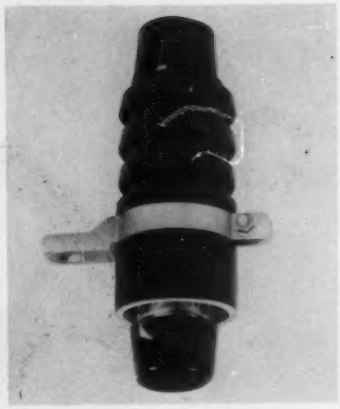
Write U-815 on reply card, pg. 17

Westinghouse 30-kv arrester

Ratings of the recently introduced type LV distribution class arrester have been extended from 27 to 30 kv, it was announced by the Westinghouse Electric Corp., P. O. Box 2278, Pittsburgh 30, Pa.

The new line now is rated from three to 30 kv. All design features of the type LV arrester have been retained in the 30-kv addition. A unique non-explosive dropout mechanism vents internal pressure for safe handling, preventing line lockout on any distribution circuit in the event of arrester damage.

Effective creep distance from line to ground has been maintained, and



"undercut" design skirts prevent contaminant collection on the heavy-duty wet process porcelain body.

Double clamshell type terminals on line and ground studs, covered by Polyvinylchloride caps for linemen protection, hold one or two copper or aluminum conductors, and double seals on each end of the arrester lock out moisture which could cause loss of arrester durability.

Write U-816 on reply card, pg. 17

S&C oil-immersed resistors

A new potential device for monitoring voltages in the 23- to 161-kv range has been introduced by S&C Electric Co., 4435 N. Ravenswood, Chicago 40, Ill., to replace conventional potential transformers.

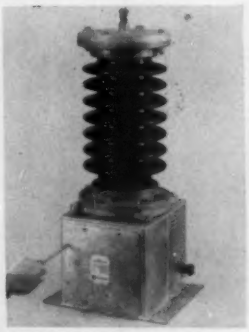
The potential device costs 65 per cent less than most comparable potential transformers.

The new device is a high-voltage, oil-immersed resistor providing up to 3.5 milliamps as a direct function of line-to-ground voltage.

With suitable accessories, the device can (1) sense voltage for automatic switching, (2) detect grounds, (3) indicate voltages through indicating lamps or meter instruments, (4) supply potential for certain relays, and (5) charge batteries.

The potential device is immune to reactive effects since it is practically pure resistance. It has no frequency sensitivity. It damps voltage surges, and can remain connected during impulse and low-frequency tests.

Write U-817 on reply card, pg. 17



Helpful literature

A new, illustrated catalog describing an enlarged line of **instruments for electrical research and production testing** has been released by **Associated Research, Inc.,** 3777 W. Belmont Ave., Chicago, Ill. Included in this catalog are dielectric test sets ranging from heavy-duty types with a-c or d-c potentials to 150 kv, hand-carried portable models, a line of instruments for testing insulating materials and insulating oils, megohmmeters with ranges to five million megohms, and instruments for many unusual applications.

Write B-818 on reply card, pg. 17

Publication GED-4269, six pages, from **General Electric Co.,** 1 River Rd., Schenectady 5, N. Y., describes in detail the reliability, safety, and convenience features of the advanced load center **unit substation** with new Powermaster type AKD-5 low voltage switchgear. The publication includes four-color photographs and an isometric view of the complete compartmentation of the type AKD-5.

Write B-819 on reply card, pg. 17

"Calculations of Inrush Currents, in Single and Multi-step Capacitor Bank Installations," technical bulletin TPC-103, shows a quick and accurate method of computing **inrush current** magnitude and frequency in shunt capacitor bank installations. It has been published by **Line Material Industries,** 700 W. Michigan St., Milwaukee 1, Wis. Equations are accompanied with one-line basic circuit diagrams and are also plotted on four different graphs.

Write B-820 on reply card, pg. 17

Easy to install, non-shattering covers for **watthour socket meters** that cut replacement costs are shown in a new bulletin just issued by **Busada Manufacturing Corp.,** 32-21 Downing St., Flushing 54, N. Y. A list of the meters which these Busada covers fit is given, along with photos and outline drawings. Flat socket meter blanks, in clear butyrate or translucent polyethylene, are also described. The blanks are designed to fit most standard bases.

Write B-821 on reply card, pg. 17

A four-page price and technical bulletin, 760, on P-L **guy wire earth anchors** has been published by **Pieper-Lillard Div., Jasper Blackburn Corp.,** 1525 Woodson Rd., St. Louis 14, Mo. Complete information is provided on the three types of P-L steel anchors: expanding, dome-plate, and power-installed screw type. Data furnished on the 28 items of anchors available includes prices, weights, physical dimensions.

Write B-822 on reply card, pg. 17

Street Light Control Shrugs off Killing Transient Voltages

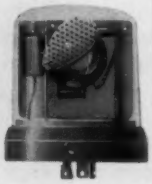
How can a compact, lightweight photo control withstand the control-killing effect of a wide range of transient voltages?

Use Varistors to absorb surges which are below the spark-over of lightning arresters. Let the lightning arrester handle the higher transients.

That's the story on simple, reliable, surge tested LUMATROL MARK I*

Write for Bulletin 91a.

LUMATROL MARK I



**Lumatrol Mark II, for 230 Volt circuits, is described in Bulletin 92.*

MICRO BALANCING, INC.
GARDEN CITY PARK, N.Y.
In Canada: J. R. KEARNEY CORP.
Box 270, Guelph, Ont.

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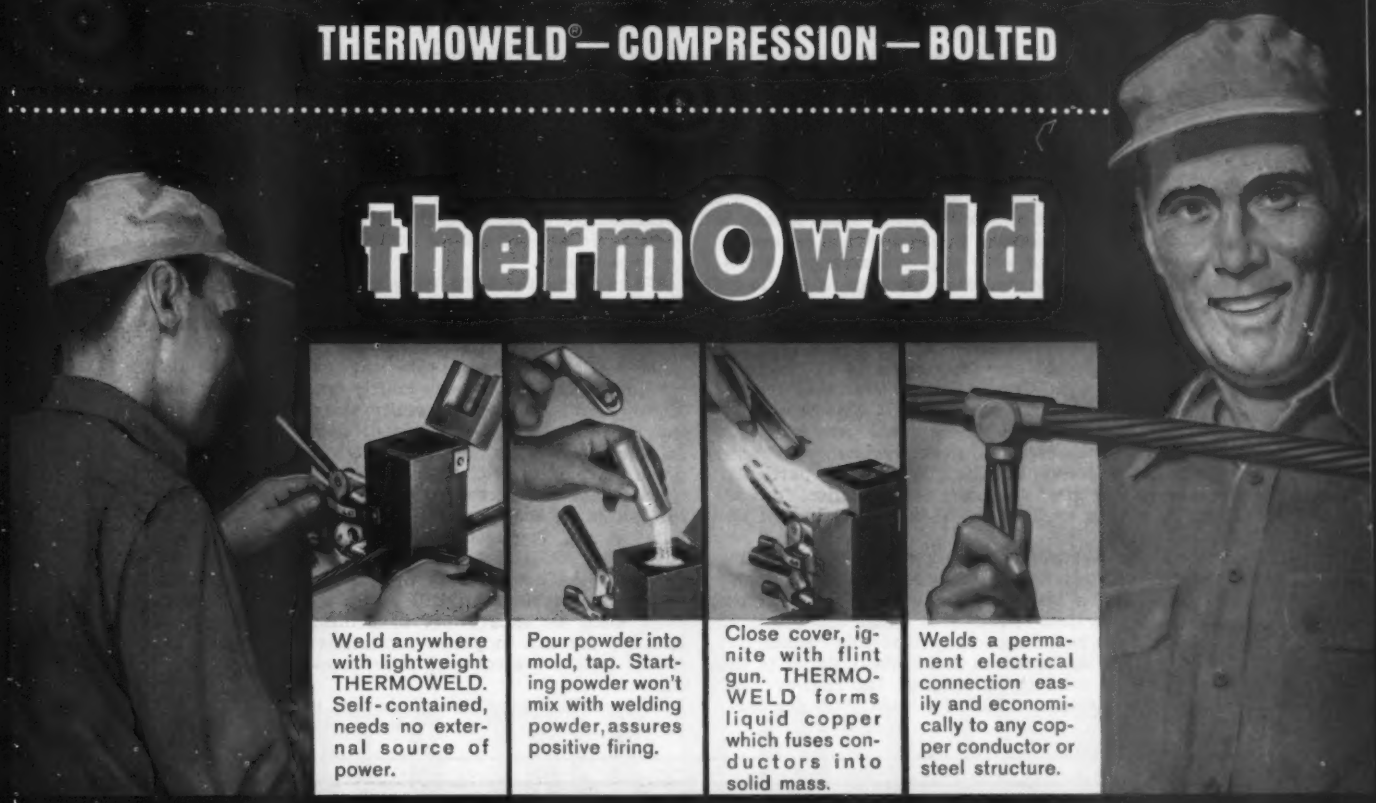

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Weld anywhere with lightweight THERMOWELD. Self-contained, needs no external source of power.

Pour powder into mold, tap. Starting powder won't mix with welding powder, assures positive firing.

Close cover, ignite with flint gun. THERMOWELD forms liquid copper which fuses conductors into solid mass.

Welds a permanent electrical connection easily and economically to any copper conductor or steel structure.

COMPRESSION

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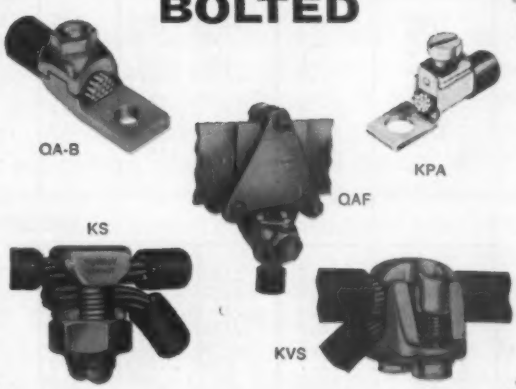

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New series of tables extended to include larger hourly rates

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

CONDUIT FLEXIBLE METALIC - WOOD WAREHOUSES

SURFACE MOUNTED

CONDUIT SIZE	HOURS "C"	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES 2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
1/2"	5.0	.10	.113	.125	.138	.15	.163	.175	.188	.20	.213	.225
3/4"	5.9	.118	.133	.148	.162	.177	.192	.207	.221	.236	.251	.266
1 "	7.1	.142	.16	.178	.195	.213	.231	.249	.266	.284	.302	.32
1 1/4"	7.8	.156	.176	.195	.215	.234	.254	.273	.293	.312	.332	.351
1 1/2"	8.7	.174	.196	.218	.239	.261	.283	.305	.326	.348	.37	.392
2 "	10.5	.21	.236	.263	.289	.315	.341	.368	.394	.42	.446	.473
2 1/2"	11.1	.222	.25	.278	.305	.333	.361	.389	.416	.444	.472	.50
3 "	12.9	.258	.29	.323	.355	.387	.419	.452	.484	.52	.55	.58
		CONCRETE WAREHOUSES										
1/2"	5.6	.112	.126	.14	.154	.168	.182	.196	.21	.224	.238	.252
3/4"	6.6	.132	.149	.165	.182	.198	.215	.231	.248	.264	.281	.297
1 "	8.0	.16	.18	.20	.22	.24	.26	.28	.30	.32	.34	.36
1 1/4"	8.7	.174	.196	.218	.239	.261	.283	.305	.326	.348	.37	.392
1 1/2"	9.7	.194	.218	.243	.267	.291	.315	.34	.364	.388	.412	.437
2 "	11.7	.234	.263	.293	.322	.351	.38	.41	.439	.468	.497	.53
2 1/2"	12.5	.25	.281	.313	.344	.375	.406	.438	.469	.50	.531	.563
3 "	14.6	.292	.329	.365	.402	.438	.475	.511	.548	.584	.621	.657

E-102-B

LABOR: Includes handling material at site, drilling access holes, notching, cutting and installing flex, strapping, attaching at terminus.

8-61

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LET'S TALK FUSE LINKS

■ Outwardly most fuse links look very much alike . . . but there the similarity ends! What, then, makes Kearney Fuse Links more dependable . . . more accurate than others? ■ Let's start with construction. All Kearney Fuse Links feature LOW temperature fusible elements and de-ionizing fibre lined tubes. Temperatures inside fuse tube and cutout cartridge always remain well below the fibre charring point . . . even after prolonged service overloads. Thus, the all-important fibre is not impaired by excessive heat . . . fuse tube and cartridge retain their original strength and arc-quenching capabilities necessary for positive full-range fault interruption ■ The exclusive de-ionizing fibre lining and extra strength of the Kearney fuse tube, in effect, make the Kearney Fuse Link a cutout within a cutout when interrupting fault currents up to 600 amperes.* Extra-long, tough, moisture and weather resistant tube provides a longer de-ionization path to clear low faults faster, more positively . . . will not warp or hang up in cartridge. Fuse tube and top terminal are securely joined to prevent loss of expulsion gas pressure ■ Select components, rigid quality control, exhaustive laboratory and substation testing guarantee strict adherence of Kearney Fuse Links to published T-C curves. For positive system protection and accurate co-ordination . . . specify Kearney Fuse Links . . . Standard or Specialized.

*An average figure varying with different fuse ratings.

KEARNEY

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For more details on above items, use reply card on page 17

CONDUIT FLEXIBLE METALIC - WOOK COMMERCIAL BUILDINGS

CONDUIT SIZE	HOURS "C"	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES 2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
1/2"	5.9	.118	.133	.148	.162	.177	.192	.207	.221	.236	.251	.266
3/4"	7.1	.142	.16	.178	.195	.213	.231	.249	.266	.284	.302	.32
1 "	8.6	.172	.194	.215	.237	.258	.28	.301	.323	.344	.366	.387
1 1/4"	9.4	.188	.212	.235	.259	.282	.306	.329	.353	.376	.40	.423
1 1/2"	10.4	.208	.234	.26	.286	.312	.338	.364	.39	.416	.442	.468
2 "	12.6	.252	.284	.315	.347	.378	.41	.441	.473	.50	.54	.57
2 1/2"	13.4	.368	.302	.335	.369	.402	.436	.469	.50	.54	.57	.60
3 "	15.5	.31	.349	.388	.426	.465	.50	.54	.58	.62	.66	.70
		CONCRETE - COMMERCIAL STORES										
1/2"	6.4	.128	.144	.16	.176	.192	.208	.224	.24	.256	.272	.288
3/4"	7.5	.15	.169	.188	.206	.225	.244	.263	.281	.30	.319	.338
1 "	9.2	.184	.207	.23	.253	.276	.299	.322	.345	.368	.391	.414
1 1/4"	10.0	.20	.225	.25	.275	.30	.325	.35	.375	.40	.425	.45
1 1/2"	11.1	.222	.25	.278	.305	.333	.361	.389	.416	.444	.472	.50
2 "	13.5	.27	.304	.338	.371	.405	.439	.473	.51	.54	.57	.61
2 1/2"	14.3	.286	.322	.358	.393	.429	.465	.50	.54	.57	.61	.64
3 "	16.9	.338	.38	.423	.465	.51	.55	.59	.63	.68	.72	.76

C-102-B

LABOR: Includes handling material at site, drilling access holes and notching; cutting and installing flex, strapping, attaching at terminus.

8-61

CONDUIT STRAPS
WOOD MOUNTING

SIZE	HOURS EACH	LABOR COST EACH AT FOLLOWING RATES 2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
"ONE HOLE"												
1/2"	.06	.12	.135	.15	.165	.18	.195	.21	.225	.24	.255	.27
3/4"	.06	.12	.135	.15	.165	.18	.195	.21	.225	.24	.255	.27
1 "	.09	.18	.203	.225	.248	.27	.293	.315	.338	.36	.383	.405
1 1/4"	.09	.18	.203	.225	.248	.27	.293	.315	.338	.36	.383	.405
1 1/2"	.09	.18	.203	.225	.248	.27	.293	.315	.338	.36	.383	.405
2 "	.11	.22	.248	.275	.303	.33	.358	.385	.413	.44	.468	.495
2 1/2"	.11	.22	.248	.275	.303	.33	.358	.385	.413	.44	.468	.495
3 "	.13	.26	.293	.325	.358	.39	.423	.455	.488	.52	.55	.59
3 1/2"	.13	.26	.293	.325	.358	.39	.423	.455	.488	.52	.55	.59
4 "	.17	.34	.383	.425	.468	.51	.55	.60	.64	.68	.72	.77
5 "	.22	.44	.495	.55	.61	.66	.72	.77	.83	.88	.94	.99
		"TWO HOLE"										
1/2"	.09	.18	.203	.225	.248	.27	.293	.315	.338	.36	.383	.405
3/4"	.09	.18	.203	.225	.248	.27	.293	.315	.338	.36	.383	.405
1 "	.13	.26	.293	.325	.358	.39	.423	.455	.488	.52	.55	.59
1 1/4"	.13	.26	.293	.325	.358	.39	.423	.455	.488	.52	.55	.59
1 1/2"	.13	.26	.293	.325	.358	.39	.423	.455	.488	.52	.55	.59
2 "	.17	.34	.383	.425	.468	.51	.55	.60	.64	.68	.72	.77
2 1/2"	.17	.34	.383	.425	.468	.51	.55	.60	.64	.68	.72	.77
3 "	.2	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90
3 1/2"	.2	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90
4 "	.22	.44	.495	.55	.61	.66	.72	.77	.83	.88	.94	.99
5 "	.28	.56	.63	.70	.77	.84	.91	.98	1.05	1.12	1.19	1.26
6 "	.33	.66	.74	.83	.91	.99	1.07	1.16	1.24	1.32	1.40	1.49

LABOR: Includes setting screw and installing strap.

8-61

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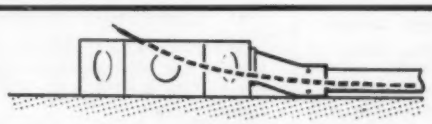
It's a Breeze!
Just a *Double Squeeze*
Sets Up E. M. T.

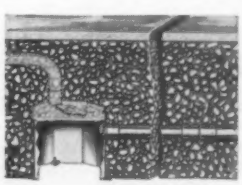
With Original B-M Indenter Fittings

B-M Indenter Fittings and Tools make an unbeatable combination when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws. Other plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—Smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.



B-M Offset Connector, showing how wires are guided over box edge.

Briegel All Steel Indenter Fittings are U.L. approved as Concrete-Tight.



BRIEGEL METHOD TOOL CO.
GALVA, ILLINOIS

All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

TELESCOPE BM SYSTEM

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USED THE MOST FROM COAST TO COAST

For more details on above items, use reply card on page 17

News of the industry

edited for Southern readers

National electric heat exposition set for '62

MEMBERS OF THE ELECTRIC Comfort Heating Equipment Section of the National Electrical Manufacturers Association met in New York recently to finalize plans for the section's second National Electric Comfort Heating Exposition and Symposium and to adopt as the theme: "Sell Electric Comfort Heating Cooperatively."

The event will be held March 19-21, 1962, in the Sherman Hotel, Chicago, Ill., scene of the section's first program. More than 3,000 people attended the 1960 program and an even larger crowd is expected in 1962. Details, as announced by K. M. Spurrier, chairman of the 1962 exposition, include discussions at seminars featuring calculations for electric heating, methods and selection of proper equipment, and selling electric heat.

All subjects will be reviewed in detail, and special emphasis will be placed on new advances in the electric heating art, such as the application of infrared heating and duct heaters, including their calculations and applications.

Prominent among the exhibitors will be manufacturers of electric heating equipment, insulation, pneumatic installation equipment, and electric heating equipment.

The exhibit and symposium will draw heavily on representatives of power suppliers, electrical manufacturers, electrical distributors, electrical contractors, dealers, lending institutions, realtors, builders, heating specialists, government agencies, and electrical and building inspectors.

Transformer division to build Florida plant

PENNSYLVANIA TRANSFORMER DIV., McGraw-Edison Co., recently announced plans for construction of a $2-million transformer manufacturing plant in Tampa, Fla.

W. E. Kerr, president of the division, stated that the new facilities will be used for the manufacture of pole type transformers, with Florida utility companies to be the primary customers.

Construction of a Florida plant has been under consideration by Pennsylvania Transformer for two years, Mr. Kerr said. Acquisition of the 12-acre site is subject to approval by the Tampa Industrial Park Management Board.

The Tampa operation will be a complete manufacturing facility rather than an assembly point. The plant is expected to be in operation by the end of the year. It is designed to employ 150 to 200 persons.

Code committee honors Brandon, past chairman

MERWIN BRANDON was presented a gavel and plaque at an NFPA annual meeting recently in Detroit.

The presentation was made from members of the National Electrical Code Committee to Mr. Brandon for his outstanding leadership as chairman of that committee.

This is the committee that is responsible for preparation of the National Electrical Code, one of the most outstanding American standards used nationally, as well as internationally.

Mr. Brandon served as chairman of this committee continuously from 1951 to 1961, when he relinquished chairmanship to H. B. Whitaker, vice-president and chief electrical engineer of Underwriters' Laboratories, Inc.

National Wiring Bureau pays honor to Doremus

TRIBUTE WAS PAID to Andrew Doremus, immediate past chairman of the National Wiring Bureau Plan Committee, at a testimonial luncheon given recently in his honor at the Sheraton-East Hotel, New York City.

Mr. Doremus, of General Electric Company's Wire and Cable Department in Bridgeport, Conn., who recently resigned his committee activities due to increased pressure of business, was presented with a scroll which was inscribed, in part: "Recognizing the significant contribution to the electrical industry, resulting from his sound, creative guidance in the development of effective adequate wiring promotional programs. . . ."

The scroll was signed and presented by Lester E. Barrett, chairman of the bureau's executive committee in behalf of the entire membership of the National Wiring Bureau.

Guests lauded Mr. Doremus for his valuable contributions during the past 13 years of service to the bureau, the last five years of which he served as chairman of the plan committee.

In addition to the scroll, Mr. Barrett, who is president of Barrett Electrical Supply Co., St. Louis, presented Mr. Doremus with a prototype of the new "Keep Pace Electrically" trophy, called the "Keepie," which will be made available by the bureau's commercial wiring promotion program for local awards "for outstanding achievement in electrical modernization."

Andrew Doremus, left, immediate past chairman of the National Wiring Bureau, receives a scroll from Lester E. Barrett in recognition of his service to the electrical industry.

Westinghouse expands for electroluminescence

WESTINGHOUSE announced recently that it has substantially expanded its production facilities for electroluminescent panels.

The new facilities will permit the company to produce the revolutionary light panels in metal, as well as in glass and plastic. Westinghouse is one of the few manufacturers producing the electroluminescent light sources in all three materials.

Electroluminescent devices which Westinghouse calls Rayescent panels are actually flat panels of glass, metal, or plastic with an electrical conductive film. They are coated with a special phosphor. When electricity is applied, the panels glow.

In the case of metal panels, the metal itself conducts electricity. There are no filaments, tubes, or vapors and practically no heat is

produced. Not only are the panels virtually fail-proof, but the current drain is almost negligible.

F. M. Sloan, Westinghouse vice-president and general manager of the company's lamp division, pointed out that with the new manufacturing facilities, the company can produce Rayescent devices to meet a myriad of lighting and decorative needs.

He said that the metal panels can be produced in sizes up to two feet square. Glass Rayescent panels can be made up to 30 inches square while plastic panels can be made in a wide variety of shapes and forms.

The manufacture of Rayescent panels bears no resemblance to the making of light bulbs, Mr. Sloan pointed out. The production of the revolutionary panels entails such operations as spraying, silk screening, and enamel baking.

Mineral wool leaders promote electric heat

THE NATIONAL MINERAL Wool Insulation Association recently distributed a packet of new electric heat promotion materials to more than 700 key electric utility executives.

In a letter accompanying the materials, Fred H. Sides, executive officer of the association, said:

"The best assist we in the insulation business can give to you who are interested in electric heating is to show that insulation for full comfort is a definite sales promotional asset, not a liability, in the sale of electric house heating."

Mr. Sides continued, "We are particularly bearing down on the fact that only electric heat recognizes the necessity of adequate insulation for true comfort, and includes it in the original cost."

Recognizing that the largest potential electric heating market is in existing homes, the largest and most elaborate folder is directed at the modernization market. It is titled: "Which Style Is Your Home? . . . Can It Be Heated Electrically?"

Two other folders are aimed at both the new and existing home market. One is titled: "Heavenly Comfort . . . by Wire!" The other is: "We've Got Electric Heat and We Love It!"

A fourth folder, called "This Home Has Electric Heat . . . the Most Modern Home Comfort System in the World!" is available for giveaway at model homes and home shows.

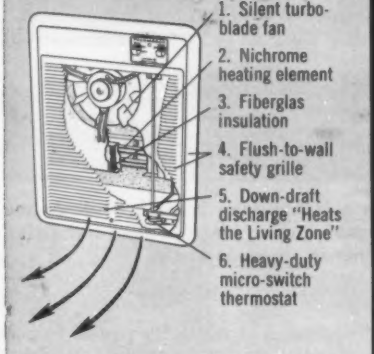
Line Material sponsors distribution seminar

PLANNING AND OPERATING tomorrow's distribution system was the keynote of Line Material Industries' second annual distribution systems seminar, held recently in two three-day sessions.

THERMADOR

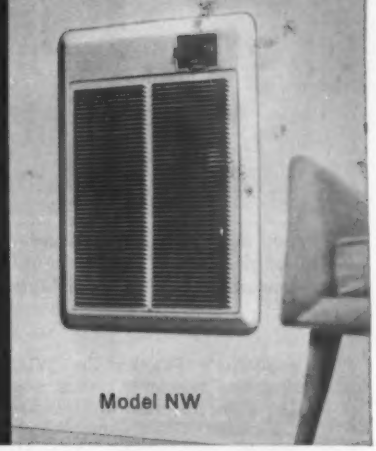
"Seven Leagues Ahead" in the science of electric heating

Most Efficient Heating!


1. Silent turbo-blade fan
2. Nichrome heating element
3. Fiberglas insulation
4. Flush-to-wall safety grille
5. Down-draft discharge "Heats the Living Zone"
6. Heavy-duty micro-switch thermostat

Master Duty Model NW —the fastest "living zone" heater

Most Modern Design!



Model NW

THERMADOR

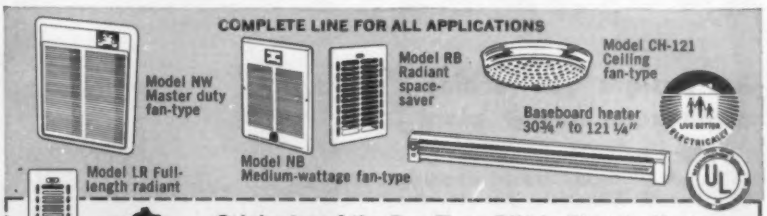
Bilt-in Electric Heaters

Millions in Use

Master Duty Fan-type Model NW (shown above) is designed for flush-to-wall installation between standard 16″ O. C. studding, without extra framing. Quiet, powerful turbo-blade fan directs heated air downward, to circulate thru the "Living Zone" of the room. No waste concentration of heated air at the ceiling.

Thermador Model NW has the *greatest heat speed of any heater.* Fast-heating nichrome wire—no heavy castings to pre-heat. Element recessed for safety. Residual heat expelled so efficiently, heater is UL approved for top wiring. Convenient top switches, neon indicator light, and safety thermo-cutout. Manual or thermostat models. Serves as an air-circulator in summer.

Spanish Gold baked enamel finish, or can be painted to match decor. 2000 to 4500 watts output, 240 volts A.C. From 6824 to 15,354 BTU's per hour. Overall grille size: 21″ high x 16¾″ wide. Projects 15/16″ from wall to edge of louver.


COMPLETE LINE FOR ALL APPLICATIONS
Model NW Master duty fan-type
Model RB Radiant space-saver
Model CH-121 Ceiling fan-type
Baseboard heater 30¾″ to 121 ¼″
Model LR Full-length radiant
Model NB Medium-wattage fan-type

Originator of the Fan-Type Bilt-in Electric Heater

THERMADOR Electrical Manufacturing Co.

Division of Norris-Thermador Corporation

5119 District Blvd., Los Angeles 22, Calif., Dept. ES-2.

Please send me illustrated literature on Thermador Electric Heaters.

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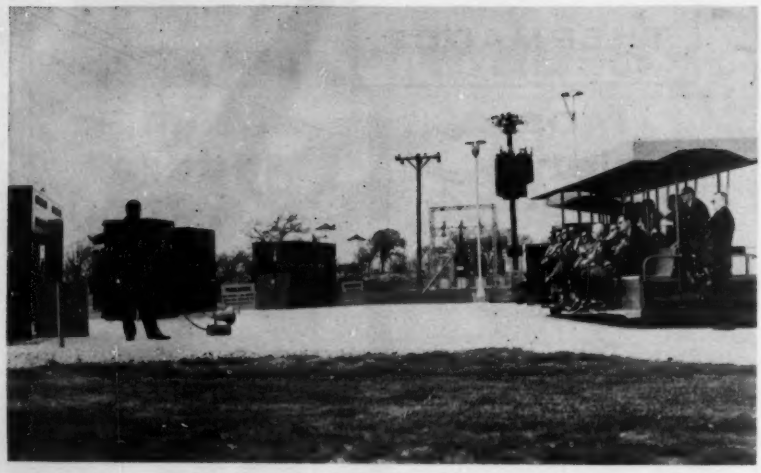
City_____ County_____ State_____



A switched capacitor bank, mounted in a transclosure housing, is described by L-M- engineer Jack Barger to utility men, during Line Material Industries' second annual distribution systems seminar, held recently.

The company's Franksville, Wis., engineering and research center was the site of a major part of the discussions and demonstrations. About 70 utility representatives from all parts of the country attended.

The trends toward higher distribution voltages, use of underground and aerial cable systems, and increased substation capabilities provided the seminar's motivation. Discussion of trends and challenges was combined with comprehensive analysis of application and design studies.

Line Material engineering and marketing personnel offered significant information about efficient, economical equipment application, with an eye toward fruitful utility growth. Regard for improved service reliability and aesthetic enhancement was coupled with consideration of system economics.

Demonstration of theoretical and practical application problems and their solution utilized the company's new high-voltage research laboratory and short-circuit laboratory facilities.

G-E designs gas turbine as package power plant

A NEW STEP in electric power generation was demonstrated recently by General Electric's gas turbine Dept.

Several hundred electric utility and industrial customers witnessed the operation of one of the nation's first gas turbine package power plants.

The package power plant was designed to provide a low-cost, remote-controlled, unattended power source. The plant can be erected quickly, and, if required, located in or near residential areas. It can be shipped by rail in four major components, installed, and normally placed in commercial service in approximately ten days.

Representatives of utility and industrial companies saw the operation of a power plant complete from concrete slab to remote control. The set-up duplicates conditions similar to those under which it will operate on the customer's system.

The gas turbine unit has been bought by South Carolina Electric & Gas Co., which has purchased four of the 11,250-kw units.

South Carolina Electric & Gas has recently installed more than 200 miles of natural gas transmission lines in its 23-county service area, enabling it to capitalize on the versatility of the gas turbine to help assure a continuing supply of low-cost electric power.

The new package power plant is rated 11,250 for peak service at NEMA conditions—80 F and 1,000 feet altitude. The over-all size of the package power plant is approximately 80 feet long, 22 feet wide, and 16 feet high.

The design is suitable for operation at ambient temperatures from a minus 40 to a plus 120 F.

Fisher-Pierce chooses Texas representatives

THE FISHER-PIERCE Division of Sigma Instruments, Inc., has recently appointed Tate and Company of Texas as a sales representative.

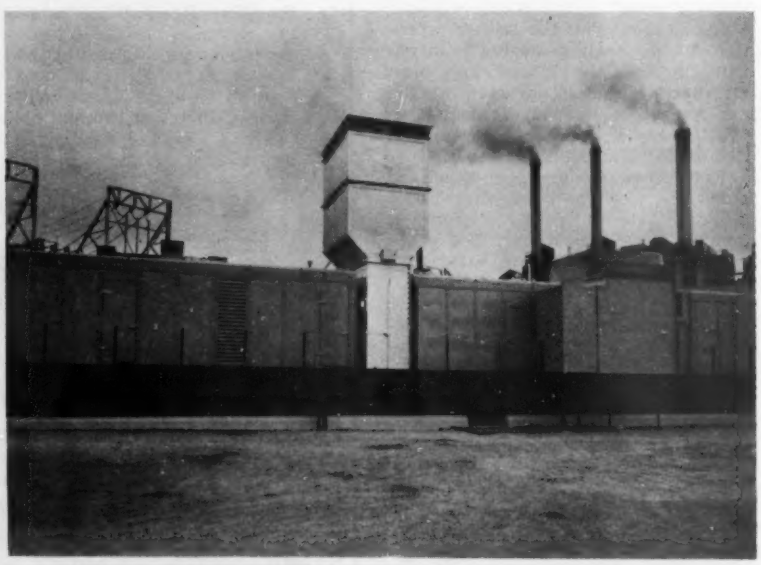
They will handle the complete Fisher-Pierce line of photoelectric controls for street lighting and electronic controls for relaying, switching, and protection of transmission and distribution systems.

Tate and Company will cover all of Texas from three offices: 3911 Oak Lawn Ave., Dallas; 3705 Bellaire Dr., S., Fort Worth; and 8711 McAvoy Dr., Houston.

Allen-Stevens makes agency appointments

FOUR AGENCIES have recently been appointed in the South and Southwest to represent Allen-Stevens Conduit Fittings Corp., Woodside, N. Y.

J. T. Fulwiler, Jr., 3133 Maple Dr.,



One of the world's first gas turbine package power plants is 11,250-kw unit recently completed by General Electric. The plant has been bought by South Carolina Electric and Gas Co., for installation at Burton, S. C.

N. E., Atlanta 5, Ga., has been named to serve the states of Georgia, Tennessee, and Alabama.

Wayne G. Parker, Box 518, Jenks, Okla., has been appointed to serve Oklahoma and Arkansas.

Covering Mississippi and Louisiana are Al Weilbaecher and Joseph D. Kennedy of Weilbaecher and Kennedy, located at 620 Girod St., New Orleans.

Texas will be served by Jack P. Morgan, P. O. Box 10755, Dallas.

Brief news notes of manufacturers

SOLA ELECTRIC CO., a division of Basic Products Corp., Milwaukee, has formally dedicated its new $3 million manufacturing and research facility at Elk Grove, Ill.

The new plant contains over 202,000 square feet of factory and office area, more than double the area of the company's old plant in Cicero, Ill.

The new plant has made possible these expansions: doubled manufacturing area, more than doubled research and design engineering, and greatly increased sales engineering, customer service, and administration.

Based on sales forecasts, the building was constructed to provide ample room for anticipated product increases for the next five years. It is built on a 12-acre site with seven additional acres recently added for possible future expansion.

* * *

THE NEW AFFILIATION of Centre Lighting, Hackensack, N. J., with Project Fixture Manufacturing Corp., Rockville Centre, N. Y., has been recently announced by the two companies.

Both firms will move to a new location in Amityville, N. Y.

Project also announced recently the appointment of Jack Brown as sales manager, replacing Elliot Arluck, on leave of absence.

* * *

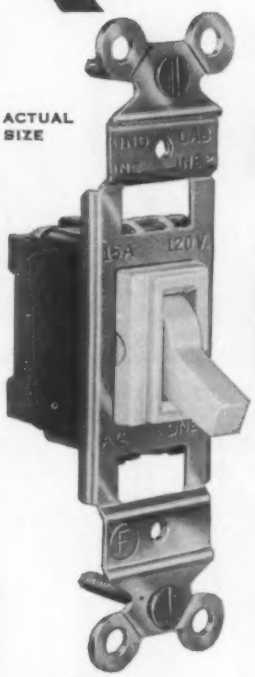
A NEW SOURCE of supply of electric and telephone crossarms is now available with the opening of the new plant of Trans-American Crossarm Co., 5151 Holmes Rd., Houston 33, Texas.

Fast deliveries, accurate manufacture, and good prices are assured by new equipment and a tested team of engineers who are accustomed to serving the wood using industries, according to T. P. Wier, Jr., president of the company.

"The plant is an outgrowth of wood treating operations conducted for the past ten years by Wood Protection Co., an affiliate," Mr. Wier said. "Trans - American will manufacture fir crossarms to REA and EEI standards and to special requirements as well. We also have a source of good pine arm stock available if the market for this develops."

QUIET

ACTUAL SIZE



new

NO-KLIK Junior™

Circle F — with precise engineering design — and without mercury or other fluids — offers the No-Klik Junior, a rugged dependable and Q-U-I-E-T wall switch.

CHECK THESE FEATURES
Raised Cover Frame Fits Snugly Into Plate for dust free operation • Large Silver Alloy Contacts for dependable duty • Fully Enclosed in Bakelite for safe, lasting performance • New Low Price for added profits

Another fine product of Circle F know-how

GUARANTEED WIRING DEVICES

CIRCLE F MFG. CO.
TRENTON 4, NEW JERSEY

For more details on above items, use reply card on page 17

Facts of Light!

IT COSTS NEARLY $2.50 TO OPERATE A 25 CENT LAMP

The electric power required to operate a 25 cent 100 watt incandescent lamp will amount to nearly $2.50 before the lamp burns out. The efficiency with which a lamp converts electric power into usable light is an important factor in considering lamp value.

TWO 100's WON'T DO THE WORK OF ONE 200

A 200 watt incandescent lamp produces approximately 3800 lumens. Two 100 watt incandescent lamps produce approximately 3400 lumens — about 10% less light.

YOU CAN CHECK YOUR LIGHTING AGAINST RECOMMENDED LEVELS FOR ALMOST 700 DIFFERENT JOBS

The Illuminating Engineering Society publishes Foot-candle Tables of Recommended Illumination (1958) for seeing tasks in many different categories and industries.

THERE ARE OVER 3,000 TYPES AND SIZES OF CHAMPION LAMPS

More than 3,000 different Champion Lamps are available to satisfy the diversified lighting needs in office buildings, homes, department stores, ball fields, theaters, factories, shops, garages, showrooms, railroads, airports, restaurants, streets, parks, schools, and many other installations.

Your Best Buy in Lamps

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT

Dates ahead

Public Utilities Association of the Virginias, White Sulphur Springs, W. Va., Sept. 14-16, 1961.

American Institute of Electrical Engineers, Petroleum Industry Conference, Jung Hotel, New Orleans, La., Sept. 17-20, 1961.

Edison Electric Institute, Eighth Annual National Electric Farm Power Conference, Leamington Hotel, Minneapolis, Minn,. Sept. 20-22, 1961.

Illuminating Engineering Society, National Technical Conference, Chase Park Plaza Hotel, St. Louis, Mo., Sept. 24-29, 1961.

National Rural Electric Cooperative Association, Region III, Admiral Semmes Hotel, Mobile, Ala., Sept. 25-26, 1961.

Missouri Valley Electric Association, Sales, Rural and Home Service Conference, President Hotel, Kansas City, Mo., Sept. 27-29, 1961.

Old Dominion Industrial Exposition, Inc., Statewide Industrial Exposition, "Index," Roanoke, Va., Sept. 27-30, 1961.

National Rural Electric Cooperative Association, Region I, John Marshall Hotel, Richmond, Va., Sept. 28-29, 1961.

National Electrical Contractors Assn., Annual Convention and Exposition, Sheraton Park Hotel, Washington, D. C., Oct. 9-12, 1961.

National Rural Electric Cooperative Association, Region X, Cortez Hotel, El Paso, Texas, Oct. 12-13, 1961.

American Institute of Electrical Engineers, Fall General Meeting, Statler-Hilton Hotel, Detroit, Mich., Oct. 15-20, 1961.

International Association of Electrical Inspectors, Southern Section, Grove Park Inn, Asheville, N. C., Oct. 16-18, 1961.

National Rural Electric Cooperative Association, Region II, Golden Gate Hotel, Miami Beach, Fla., Oct. 30-31, 1961.

Fourteenth Annual Power Distribution Conference, University of Texas, Austin, Texas, Oct. 30-Nov. 1, 1961.

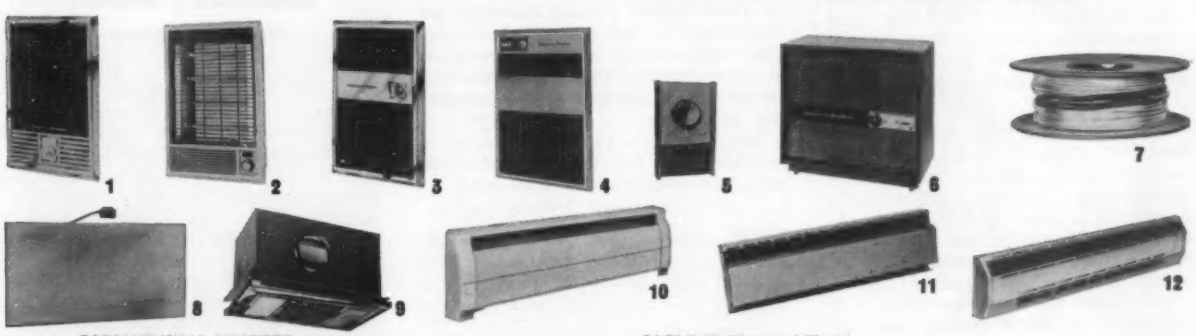
National Rural Electric Cooperative Association, Region VIII, Jung Hotel, New Orleans, La., Nov. 2-3, 1961.

American Institute of Electrical Engineers, Winter General Meeting and Electrical Engineering Exposition, New York Coliseum, Jan. 29-Feb. 2, 1962.

For more details on above items, use reply card on page 17

The exciting trend is to ELECTRIC HEATING—and the HOT LINE is AMERICAN-STANDARD "ELECTRI-WARM"!

"Electri-Warm"—the complete line of quality heating equipment that's priced to compete . . . American-Standard—the name you don't have to sell, you capitalize on . . . put these names together and you have American-Standard "Electri-Warm," the prestige entry in the fast-growing field of electric heating. There are "Electri-Warm" units for ceiling, wall, baseboard, floor—any place and every place you might be called on to install an electric heating unit. And the call for quick, clean, silent, maintenance-free electric heating is growing stronger and stronger all the time. The switch is on! The exciting trend is to electric heating—and the hot line is American-Standard "Electri-Warm"!



RADIANT WALL HEATERS
1 Ribbon Type—120-240 Volt—three sizes
2. Vycor Type—120-240 Volt—four sizes

FAN FORCED WALL HEATERS
3. Standard Type—120-240 Volt—two sizes
4. High Capacity—120-240 Volt—five sizes

CONTROLS
5. Five Thermostats (low and line voltage)

PORTABLES (Fan Forced)
6. 240 Volt—Dual Range—Integral Thermostat—three sizes

CABLE (Ceiling and Floor)
7. 240 Volt—Standard Reel Sizes

CEILING PANEL
8. Printed Circuitry—120 or 240 Volt—500 Watts

CEILING HEATER-LIGHT-EXHAUST-CIRCULATOR
9. Combination Unit—120 Volt—1450 Watts (Heating)

BASEBOARD
10. Economy—240 Volt—Low Density—four sizes
11. Standard—240 Volt—Low Density—four sizes
12. Deluxe—240 Volt—Hi-Density—four sizes

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American-Standard PRODUCTS

AMERICAN-Standard
AIR CONDITIONING DIVISION
ELECTRIC HEATING DEPARTMENT

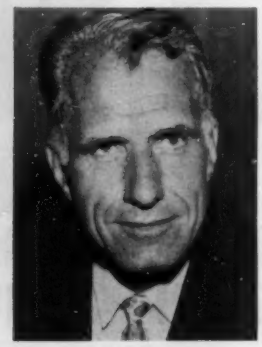
AMERICAN-STANDARD ELECTRIC HEATING DEPT., 40 W. 40th ST., N. Y. C.
Send me details on selling the "Electri-Warm" electric heating line.
Name.....Position.....
Company.....
(Distributor? Contractor? Other?).....
Address.....
City.....Zone....State.....

For more details on above items, use reply card on page 17

News about people

Dan E. Dunne has been appointed manager of marketing for Smithcraft Corp., it was announced recently by **Louis Newman,** president of the company.

Mr. Dunne has been actively associated with the lighting industry in a management capacity for many



Dan E. Dunne

years. He has held management positions with Lighting Products Corporation and the Penn-Union Electric Corp.

He is an engineering graduate of Illinois Institute of Technology, and has done graduate work at Northwestern University. He has also completed the General Management course and conducted seminars at the American Management Assn.

John G. Beam was elected president of Thomas Industries, Inc., Louisville, Ky., lighting fixture manufacturer, by the firm's board of directors at a meeting in Chicago recently. He succeeds **Lee B. Thomas,** who continues as chairman of the board and chief executive officer.

Mr. Beam has been executive vice-president of the company for the past three years. Prior to joining Thomas Industries, he was executive vice-president of American Saw Company in Louisville.

The new president is a graduate of the University of Louisville.

Clarence C. Keller has become president of Holophane Co., Inc., it was recently announced.

He succeeds **Charles Franck,** president since 1929, who will continue as chief executive and chairman of the board of directors.

Mr. Keller joined the company as test engineer in 1929 after graduating from Ohio State with a degree in electrical engineering. He became manager of application engineering, then sales manager, vice-president in charge of sales, executive vice-president, director, and now president.

He is vice-president and a member of the board of governors and officers committee of NEMA. He is also active in IES, and has been general secretary, director, and vice-president of the society.

Moloney Electric Company has announced the appointment of **Donald E. Spackler** as general manager of Moloney's new Switchgear Div.

Mr. Spackler, who has been associated with Moloney since 1950 and for the past seven years a vice-president, played the key role in the development of the company's five-and 15-kv metal-clad switchgear.

Prior to working on this new development, he was primarily concerned with coordinating transformers and switchgear for unit substation sales. He is a graduate electrical engineer and holds a masters degree in business administration.

The company also announced that **Carl E. Mercier** has been chief design engineer during the development of Moloney metal-clad switchgear. For 17 years before joining Moloney, he specialized in all phases of switchgear engineering and in particular, characteristics of switchgear relevant to dielectric, thermal, and interrupting properties.

Mr. Mercier is a graduate electrical engineer and has done considerable post graduate work in this field.

The appointment of **Phillips M. Darby** to assistant vice-president and general sales manager of Appleton Electric Company was recently announced by **Arthur I. Appleton,** president of the company.

Phillip M. Darby

Before this appointment, Mr. Darby was general sales manager, a position he has held since June, 1959, and before that had been sales manager of the Appleton Unilet and Reelite Divisions. His career with the company began in 1948 when he joined the staff in the Cleveland office as a field engineer. He is a graduate of Western Reserve University in Cleveland.

Walter R. Stone, well-known authority on the National Electrical Code, and a contributing editor on Code matters for ELECTRICAL SOUTH and *Lighting* magazines, has been appointed associate editor of the *News Bulletin* published by the International Association of Electrical Inspectors.

Mr. Stone will continue his Code articles in ELECTRICAL SOUTH and *Lighting*, as well as his work with New York Board of Fire Underwrit-

Walter R. Stone

ers, while carrying on the new assignment for the IAEI *News Bulletin.*

Mr. Stone attended Texas Christian University, Columbia University, and the University of Texas, and is also a graduate of Navy electrical courses and of the Maritime Commission upgrade school in marine engineering.

With some 26 years of electrical experience, Mr. Stone has been chief inspector with the New York Board of Fire Underwriters for the past 3½ years.

Prior to this position, he served for eight years as chief electrical inspector for Fort Worth, Texas. Other experience includes teaching in an electrical apprentice training program for four years.

Joe Bussmann, Jr. has been newly installed as president of the St. Louis Electrical Board of Trade at the board's annual executive committee meeting.

Mr. Bussmann succeeds **Joseph B. Schaeffer,** of Sachs Electric Corp.

Also installed as officers were

Eugene R. Kropp, vice-president of Union Electric Co., as first vice-president; **William E. Newman,** vice-president of C. B. Fall Co., as second vice-president; and **C. E. Butler, Jr.,** president of Butler Electric Co., was installed for his seventh term of office as treasurer.

Harry Guest, board executive vice-president, was re-employed as the board's administrative executive officer.

Mr. Bussmann, the new president, has long been active in the electrical board's affairs. He has served the organization as first and second vice-president; as chairman of the organization's 1959-60 program committee; and, for several years, as chairman of its industrial section program committee and as chairman of the group's trade show committee.

He is also serving his second term as president of the Electronic Club of St. Louis.

Roy H. Hainsworth has been named assistant to the director of electrical market sales by Reynolds Metals Co.

He formerly was product sales manager for John A. Roebling's Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J. Mr. Hainsworth has been associated with the electrical industry for the past 15 years.

J. Brady Stoughton, Jr., has been named Line Material's new South Atlantic region manager.

He succeeds **R. C. Hunt,** who died recently.

THIRTY-FIVE YEAR PIN—Lawrence G. Maechtlen (left), president of Square D Co., receives a 35-year service pin and congratulations from the man who hired him in 1926, Joseph H. Pengilly, a vice-president and director of Square D. The presentation was made at corporate headquarters in Park Ridge, Ill.,

Mr. Stoughton, an electrical engineering graduate of Georgia Tech, came to L-M in 1950 as lighting engineer in Atlanta. In 1960, he was transferred to Tampa to assist in regional management affairs.

He will continue to headquarter in Tampa for sometime, but eventually will transfer back to Atlanta.

Karl K. Kreamer was elected vice-president in charge of operations of Houston Lighting & Power Company at a meeting of the company's board of directors held following the company's recent annual stockholders meeting.

The directors also re-elected all of the other officers of the company.

Mr. Kreamer, a native of Lake Charles, La., and a 1928 graduate of Rice University, joined the company in 1935 as its oil field power sales engineer. During both World War II and the Korean War, he was the company's representative in Washington, D. C., maintaining liaison with various governmental agencies concerned with power supply and procurement of materials required in the war effort.

He was named assistant to the vice-president in charge of operations in 1956.

In his new post, Mr. Kreamer will supervise power generating operations, construction and maintenance of transmission and distribution facilities, and operations of the company's engineering, dispatching, and transportation departments.

Officers re-elected at the meeting are **T. H. Wharton,** president; **P. H. Robinson,** executive vice-president; **F. M. Austin, C. B. Sherman, H. F. Staacke,** and **J. F. Estill, Jr.,** vice-presidents; **J. G. Reese,** vice-president and comptroller; **J. A. Bordelon,** secretary and treasurer; and **C. F. Ellison, Jr.,** and **H. E. Gatlin,** assistant treasurers.

Walter T. Callaghan has been appointed general sales manager of Bell Electric Co., Chicago, it was announced recently by **Harry L. Stillman,** president of the company.

Mr. Callaghan's previous background in the lighting field includes over ten years of sales management work with Steber Manufacturing and Pyle National Companies.

Appointment of **Bruce A. Fleming,** vice-president in charge of sales, Edwin L. Wiegand Co., to executive vice-president, has been announced recently by **E. N. Calhoun,** president.

Mr. Fleming joined the company in 1940 as assistant to the president. He rose to the position of vice-president and director in 1943 and has held that position up to the present time. During his career, he has become well known in the electric heating and appliance industries.

T. M.®
"SNAPER" STRAPS
T. M.®
FOR THIN WALL & RIGID CONDUIT

THE SNAPPER
SNAP ON - STAY ON

THE STANDARD . . .
. . . THE ORIGINAL
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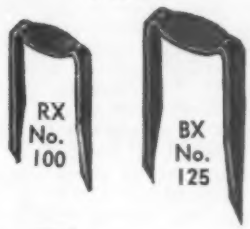

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Technical books

for the electrical man

Utility pioneer

"S. Z. Mitchell and the Electrical Industry," by Sidney Alexander Mitchell. Published by Farrar, Straus & Cudahy, 101 Fifth Ave., New York 3, N. Y., 178 pages, photographs, $5.00.

A biography of an important pioneer in the electric utility field, this book presents valuable source material on events that took place during the formative period when this rapidly growing industry required ever increasing capital expansion.

Recognizing the special talents which S. Z. Mitchell brought to this phase of the electric utility industry's development, Roger Babson once said, "The utilities today owe more to Thomas A. Edison and Sidney Z. Mitchell than to any other men. Mr. Edison invented the basic equipment of the industry; while Mr. Mitchell provided means of financing Mr. Edison's inventions. One was the 'lock' and the other the 'key.' Either would have been helpless without the other."

Mr. Mitchell was active in the power industry from 1885, six years after Thomas Edison lighted his first incandescent lamp, until his retirement in 1933, two years before the passage of the Public Utility Holding Company Act.

The book covers the organization of the first primitive electric companies in the West, the development of the holding company as a financial device, and the growth and financial record of the companies supervised by the Electric Bond and Share, of which S. Z. Mitchell was the head.

It shows S. Z. Mitchell as a man of imagination in accomplishing his ends, exceptional ability in understanding and dealing with people of all types, and in creating, building, and coordinating industrial enterprises.

He was born in Alabama, and the book contains a brief description of life in this part of the South from 1821 to 1879.

Throughout the book contemporary events and problems are discussed, and their relationship to the developing power industry explained.

Sidney A. Mitchell, author of the book, is the son of S. Z. Mitchell, and worked on the staff of Herbert Hoover when the latter was United States Food Administrator during the First World War. Between the two world wars he was a successful businessman in New York with particular interest in the electrical industry.

He served as executive director of the first Commission on Organization of the Executive Branch of the Government, created in 1947, and also served on the subsequent commission.

Mr. Hoover, in describing the author and the book says, "This book is indeed a biography of his father and the early years of the electrical industry, and Mr. Mitchell's own experiences in public affairs and in business during all of these more than 40 years have enabled him to produce a significant volume."

Customer handling

"Satisfying Customers for Profit." Published by Howard W. Sams and Co., Inc., 2201 E. 46 St., Indianapolis 6, Ind., 104 pages, $1.25.

One of the most prevalent problems in running a service-type business lies in the proper handling of customers and their problems.

This book uses a conversational style to present 25 field-tested case-histories, typical of those most likely to confront a radio-TV service dealer (although the basic principles involved can just as well apply to any service type business).

For greatest reader interest, a storybook script lets the reader see what happens when a prosperous service shop owner and his employees meet with situations that spell the difference between winning or losing a customer.

With this approach, shop owners and servicemen can see themselves in these situations, and learn how to apply the proper techniques in their daily contacts with customers.

At the end of each episode, the main points concerning customer relations are summed up in four or five brief sentences. Following this, the reader is asked several specific questions relating to the customer relations problems dealt with in the story. Answers to these questions, permitting the reader to check his own customer-handling ability, are contained in a special section in the back of the book.

Some of the problems dealt with include: how to handle the customer who thinks he received a lemon; what to say when the customer complains that hourly service charges are too high; how to relate TV failure in terms the customer can understand; and how to explain why the same trouble symptoms needn't be caused by failure of the same parts.

IES sports lighting

"IES Current Recommended Practice for Sports Lighting," by the IES Committee on Sports and Recreational Areas. Published by the Publications Sales Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y., 48 pages; one to 24 copies, 50¢ each; 25 to 99 copies, 40¢ each; 100 or more copies, 35¢ each.

This new book covers lighting for sports ranging from major professional baseball and football games to recreational and playground activities such as horseshoe pitching and croquet.

Introductory chapters discuss the general purpose and scope of lighting for sports and factors of good illumination for such areas. Lighting requirements from the standpoints of players, spectators, and commercial interests follow; then descriptions of lighting equipments and systems to meet these requirements.

Recommended layouts of equipment for lighting indoor and outdoor sports are included as well. There is a thorough coverage of the maintenance program involved in operating a sports lighting system efficiently.

As well as guiding professional lighting engineers and specialists, the new "IES Current Recommended Practice for Sports Lighting" will help many who are interested in correct sports lighting, including teams and participants and their management; municipal school and recreational authorities; colleges and universities; consulting engineers and designers; construction and electrical contractors; and many others.

Electronic drafting

"Electronic Drafting Handbook," by Nicholas M. Raskhodoff. Published by The Macmillan Co., New York, N. Y., 402 pages, 72 tables, 186 drawings, $14.75.

The meteoric growth of the electronics industry in the United States has created many new opportunities for draftsmen, and "Electronic Drafting Handbook" presents the specialized skills of the newest branch of engineering drawing in a comprehensive, easy-to-use volume.

The book shows how to prepare every kind of electronic drawing, and many finished drawings are included. A section crammed with photographs and figures introduces the beginner to the basic electronic and mechanical components. Typical drafting room practices, techniques of drafting, and checking procedures for mechanical and circuit drawings are fully covered.

Author Raskhodoff is an engineering designer with the U.S. Naval Research Laboratory in Washington, and holds several patents.

New products

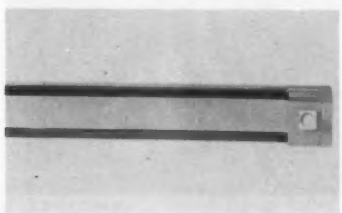
Sundial baseboard heaters

A new, advanced electric baseboard designed for fast labor-saving installation in multi-home developments, custom houses, apartment and multistory buildings, motels, churches, and commercial and industrial installations is now being manufactured by Sundial Electric Corp., 130-15 89th Rd., Richmond Hills 18, N. Y.

Competitively priced, handsomely designed and engineered, this baseboard features a copper-aluminum heating element and a special patented fin design. The element consists of coiled Nichrome wire in solid ceramic and is sealed with ceramic bushings.

The patented fin construction, known as the fin-touch-fin design, was created to eliminate noise. The fin design also increases the heat transfer surface and reduces dust clogging. A slide action expansion clip cradles the element, allowing it to glide silently over the steel support bracket.

Some of the other features are the labor-saving accessories, including the exclusive piano-hinged connection box with a lid-mounted thermostat (½ F), snap-on end caps, snap-on linear joints for "in-line" joining, and an exclusive piano-hinged inside corner which permits the joining of baseboard sections at any angle.



Write P-823 on reply card, pg. 17

Rybolt ducted furnace

A new ducted electric furnace providing many advanced features has been announced by the Rybolt Heater Co., Ashland, Ohio.

One model furnishes complete installation flexibility for hi-boy, counterflow, or horizontal applications. It is U.L. approved for zero clearance on sides and rear and provides instant shut-off and return to minimum starting load in event of power failure or limit cut-off. This reduces wire size requirements and eliminates power surge problems.

Controls are not affected by ambient temperature and each stage is positively sequenced and timed in fixed steps. This gives modulated heat by turning on only the number of stages needed to match heat loss. The blower is belt driven and separately controlled to eliminate cold air at the register for maximum owner satisfaction.

Complete stage selection is available from ten kw (34,200 Btu) to 25 kw (85,500 Btu). This assures easy field selection and adjustment in five-kw steps. It is designed for air conditioning with all equipment needed available from Rybolt.

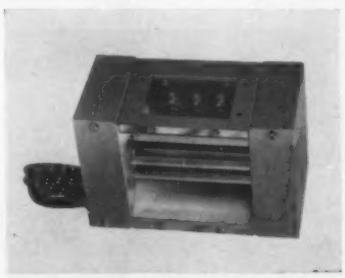
Write P-824 on reply card, pg. 17

Radcor radiant heat unit

A compact, portable electric radiant heat unit for demonstrating effects on process and comfort of metal sheath, quartz tube, and quartz lamp elements is being offered by Radcor, Inc., Bradner, Ohio.

The unique demonstrator, designated LND-11S, has been made available for use by utilities, electrical contractors, and distributors.

It houses the three different infrared elements, each operated by a separate toggle switch. Behind the elements of five-inch heated length is a specular type S gold reflector having 95 per cent efficiency, with end cap covers of the same



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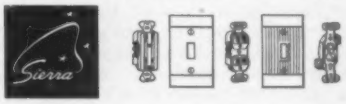


material. The device operates on 115-volt a-c or d-c current and is equipped with a six-foot cord and plug.

The unit is sturdily built yet light in weight for ease of handling.

Write P-825 on reply card, pg. 17

Hunter convection baseboard

A modern, space-saving convection baseboard heating unit now available from Hunter Div., Robbins & Myers, Inc., 2500 Frisco Ave., Memphis 14, Tenn., is especially designed for bathrooms. The chrome faceplate and white casing of the units blend with standard bathroom fittings.

The unit installs against a bathroom wall and is available in either 120-volt or 240-volt models. A built-

in thermostat automatically regulates bathroom comfort level. The bathroom may be maintained at a desired temperature or left at low-level heat to be warmed as preferred.

The unit is protected by a thermal cut-out switch which prevents overheating should airflow accidentally be restricted or cut off. The casing maintains a warm surface that won't damage fabrics or harm the sensitive skin of children. Ratio of delivery to radiant heat is 9:1.

All models are 34¼ inches long, 6⅜ inches high, and 2¼ inches wide, and have high density heating sections.

Write P-826 on reply card, pg. 17

Westinghouse heating

Several new products have been added to the line of residential electric heating equipment available from the Westinghouse Electric Corp., Air Conditioning Div., Staunton, Va.

They include a new three-foot-long baseboard section rated at 750 watts, a new combination thermostat-switch -outlet section, and a wood dummy baseboard section.

The new three-foot-length section incorporates all the advantages previously available with the two-foot baseboard sections: the unique modular plug-in concept that simplifies installation time, reduced overall size, unique three-way air flow design that permits the surface of the units to remain cool while in

operation, and modern functional design.

This three-foot section is available in 120-, 208-, 240-, or 277-volt ratings. It is rated at 750 watts and provides 2,560 Btu's per hour per section.

The combination thermostat-switch -outlet section is 9½ inches long and contains a standard heating thermostat and a 220-volt outlet for use with room air conditioners. A summer-winter selector switch permits switching from heating to cooling.

The functional modern design of the baseboard heating units can now be carried completely around any room with the introduction of the new wood dummy baseboard sections. The section is painted to match the existing line of baseboard heaters or it can be painted to match any decor.

The sections come in 4½-foot lengths and can be cut with any hack saw to provide wall-to-wall attractive baseboard.

Write P-827 on reply card, pg. 17

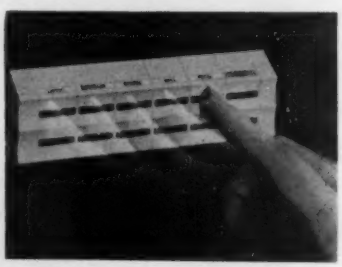
Reiner remote control unit

A new advance in man's ability to control scores of electrical and mechanical devices from various remote points is dramatically shown in the new Swepe remote control system made by Reiner Industries, P. O. Box 27878, Los Felia Station, Los Angeles 27, Calif.

With the advent of Swepe, an unlimited number of individual lights, appliances, and even entire electrical circuits may be controlled from multiple remote points in a building by means of safe, specially designed low-voltage switches and relays.

Printed nameplates with two levels of illuminated intensity clearly identify outlets or circuits controlled by the switches and show which ones are on or off.

A prime feature of the handsomely



styled switches is their pancake thinness — permitting them to be mounted either flush with almost every conceivable wall thickness without regard to structural framing members or to be placed on the surface of the wall, protruding no further than the toggle of a conventional switch.

Because of their modular design, any desired number of switches may be mounted in a continuous strip and simultaneously controlled with one sweep of the finger.

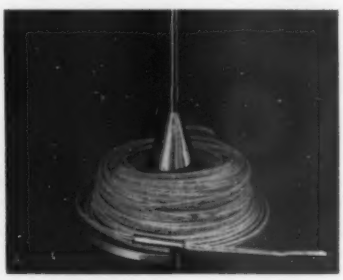
Swepe's modular electrical components may flexibly be changed and rearranged to suit new or changing needs by any householder without fear of shock.

Write P-828 on reply card, pg. 17

Browne electric wire reel

A newly introduced wire reel by Brown Electric, 216 Esplanade, Capitola, Calif., is designed to save considerable time in domestic, commercial, or industrial wiring jobs when using single-conductor, strand, non-metallic sheathed cable or BX.

The device makes stringing easier, and eliminates any possibilities of kinks, skins, or bruises. It is equipped with a pivotal guide that enables the wire to be pulled from any direction,



as well as a guide sleeve that keeps the wire straight and retards backlash.

A greased bearing on the undercarriage of the reel provides for minimum pulling effort. The device hooks over any ceiling joist, so that the building can be worked from a central point.

Write P-829 on reply card, pg. 17

Infropake fluorescent filter

Infropake Corporation of America, 1015 Warehouse St., Greensboro, N. C., announces a newly developed lighting product, the "Infropake Filtersleeve."

Filtersleeves are intended for any high intensity fluorescent lighting installation where eyestrain, color discrimination, fabric or paint fading, or synthetic fiber degradation are unsolved problems.

Alleviation of these difficulties is achieved by a specially impregnated plastic film, which filters the ultraviolet energy transmission. Filter-

sleeves are available in all sizes and are reusable.

The clear plastic film passes 90 per cent of the visible light, but filters out the ultraviolet emissions, and thereby eliminates the fading, degradation, and deterioration of fabrics, plastics, and metal paint finishes, which are caused by ultraviolet light.

This results in better color discrimination, a marked reduction in glare specular reflections, and a more comfortable diffused light.

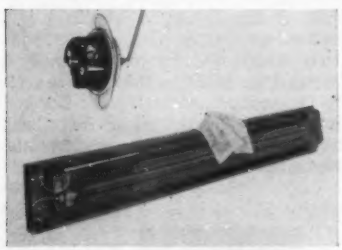
Write P-830 on reply card, pg. 17

Seaboard safety heat cutoff

Electric baseboard heaters made by Seaboard Products Corp., 191 Frelinghuysen Ave., Newark, N. J., are now equipped with a radically new safety device, Safe-T-Stat, to prevent overheating should pillows, sheets, or towels fall on the heater.

This device is so sensitive that a lace handkerchief dropped on the heater automatically shuts off the electric current.

A blue ribbon trade-mark identifies heaters equipped with this new safety device. When a handkerchief



or any other object is dropped on the heater it causes a rise in temperature. This increased temperature is immediately transmitted along a liquid filled capillary tube which runs the full length of the heater.

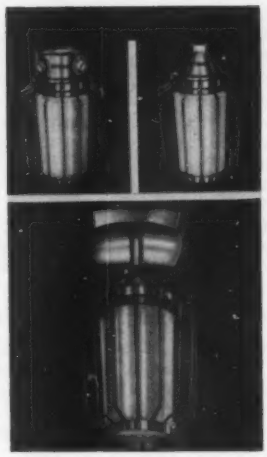
The device is then activated to break the circuit and shut off the power. After a 50-degree temperature drop, power is automatically switched on. This means that as long as the object remains against the heater this off-on safety cycle repeats itself—without anyone turning off the power switch.

This full length capillary feature is superior to spot cut-off switches used up to this time. With spot cut-off switches only certain sections of the heater are sensitive to overheating—not the full length.

Write P-831 on reply card, pg. 17

Stonco vaportight fixtures

A new line of decorative vaportight lighting fixtures just announced by Stonco Electric Products Co., 333 Monroe Ave., Kenilworth, N. J., is designed to protect architectural lighting installations from premature failures caused by rain, ice, sleet,



corrosive fumes, or non-explosive vapors and gases.

Fixtures are in gleaming satin finish with tapered opal diffusing globes and chrome-plated decorative guards for use in breezeways, basements, building exteriors, lobbies, lavatories, storerooms, stairways, corridors, and other locations where crisp, smart design must withstand seeping moisture and the elements.

The complete line in up to 200-watt sizes includes one- and two-light units for ceiling or custom pendant mounting, all high-pressure precision die-cast in strong, lightweight aluminum for cleaner, easier installations.

Write P-832 on reply card, pg. 17

Corning radiant heater

The Vycor brand space heater is now being marketed for general commercial and consumer use, Corning Glass Works, P. O. Box 544, Corning, N. Y., has announced.

Initially offered for heating applications in and around farm buildings, the radiant heaters are now available for warming personnel working anywhere outside or in any unheated area.

The Vycor brand heater emits high efficiency long wave infrared rays from wire coils encased in a tube of 96 per cent silica glass. This glass has high infrared transmission and

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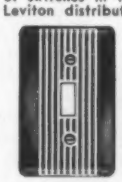

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For more details on above items, use reply card on page 17

is resistant to heat, sudden temperature change, and corrosion, the manufacturer said.

The unit can be installed on either the ceiling or the wall by wiring it into the electrical system. The 1,650-watt heater operates on alternating or direct current. It is designed for 120-volt power supply. Two heaters can be wired in series on a 240-volt line.

The unit is 50½ inches long, seven inches wide and weighs seven pounds. It is framed in aluminized steel and comes equipped with an aluminum reflector, junction box, leads, and mounting hangers.

Write P-833 on reply card, pg. 17

Ampere all-radiant heaters

An entire series of all-radiant heaters in baseboard, ceiling, wall, and portable units is now available from Ampere Industries, 60 Boston St., Newark 3, N. J.

The new baseboard panels utilize the Amp-Quartz element for high, all-radiant output. Modern, low, and compact, the units are available in three sizes for maximum flexibility, and can be placed end to end for any size room. They can also be turned inside or outside corners.

These panels are available with thermostat section, and feature an individual thermostat in each room for true heat zoning. They also have a silver hammered motif for the finish. The units can be surface mounted or recessed.

Write P-834 on reply card, pg. 17

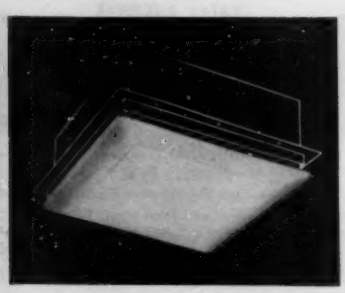
Litecraft incandescent series

A new series of finely engineered incandescent lighting fixtures, designed along classically simple lines, is available from Litecraft Manufacturing Co., 100 Dayton Ave., Passaic, N. J.

Called the Endura series, fixtures in this new line include incandescent recessed squares, darklights, baffled downlights, Alzak downlights, adjustable accent lights, and recessed round regressed lens lights.

The Endura series is designed to add an important finished appearance to commercial, institutional, and residential interiors.

Endura recessed units are built to fit precisely into the ceiling and become an integral part of it.



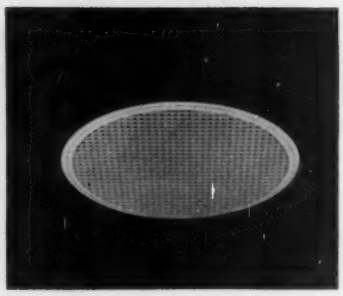
Other features are efficient Alzak reflectors; steel parts Bonderized after fabrication; 18-gauge cold rolled steel housings; double gasketing for a positive seal against light leakage, dust, and moisture; top relamping; anodized face frames for permanence indoors and out; and hinged face frames with positioning springs for relamping safely from below.

Write P-835 on reply card, pg. 17

Neo-Ray round fluorescents

Neo-Ray Products, Inc., 315 E. 22nd St., New York 10, N. Y., has developed one of the first louvered round fluorescent recessed two-, three-, and four-foot diameter fixtures in the lighting industry.

These round units, Neo-Ray's 700 series, feature the new small cell aluminum louver, Scallop-Cel, with



vinyl plastic laminated to the top for complete shielding of lamps from all viewing angles. Very low brightness with warmth of design are highlights of this series, which is ideal for lobbies, reception rooms, executive offices, etc.

Write P-836 on reply card, pg. 17

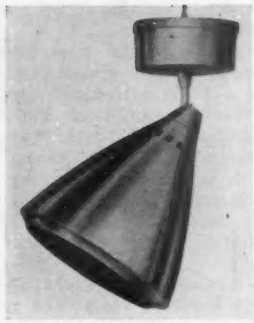
Swivelier high-bay fixtures

A completely redesigned and augmented line of adjustable fixtures for high bay lighting in auditoriums, museums, churches and all other high ceiling lighting applications is now available from the Swivelier Co., Inc., 30 Irving Pl., New York 3, N. Y.

For the PAR-56 and PAR-64 lamps, Swivelier is introducing its Tripoli shade. There is an outlet box unit and a clamp unit, with two-conductor cord, for each lamp—plus a special clamp model with grounded three-conductor cord for the PAR-56 lamp only. All units are finished in kiln-baked aluminum enamel.

Outlet box units are furnished with the Shur-Mount plate which provides easier, more secure mounting. Clamp models attach to up to two-inch flat or cylindrical surfaces and are protected to prevent scratching of surfaces.

For the PAR-56 and PAR-64 lamps, Swivelier offers five different versions, all with the new brushed satin aluminum Bermuda 46 shade: two



outlet box units (one for emergency low-voltage lighting), two clamp units, and one Trol-E-Duct model.

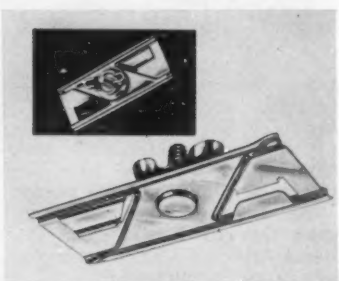
Write P-837 on reply card, pg. 17

Tomic T-bar fixture hanger

"Tomic-Lock," a new T-bar hanger designed to simplify mounting of electrical fixtures to acoustical ceilings, has been announced by Tomic Sales & Engineering Co., 20,000 Sherwood, Detroit 34, Mich.

The new hanger has been extensively field tested for more than a year, and according to the manufacturer has a holding capacity equal to that of the T-bar to which it is attached.

Installed without tools simply by twisting it into position on the supporting member, the Tomic-Lock can be easily adjusted after installation. It is constructed of spring steel, measures 1½ by 3½ inches, and is



designed for use on any standard T-bar.

Write P-838 on reply card, pg. 17

Quicktime box connector

A new electrical box connector introduced by Quicktime Electrical Products, 3643 W. 115th Pl., Chicago

55, Ill., features timesaving, cost-saving advantages for both the electrical contractor and original equipment manufacturer.

Wherever back-to-back installation of electrical outlet or switch boxes is called for, this connector allows rapid, easy mounting and rugged construction at low cost.

The connectors are quality zinc die-cast nipples, threaded at both ends, with a heavy spacing collar in the center. Two steel locknuts are supplied with each, providing a complete assembly.

The use of the connectors eliminates the need for box clamps and associated hardware. They also help reduce costly conduit bending and fitting operations.

Careful design and close dimensional tolerances make Quicktime "900" connectors well suited to building construction using either plaster or dry wall.

Write P-839 on reply card, pg. 17

Helpful literature

available to our readers

A folder now available from **Cavalier Corp.,** 343 W. First St., Chattanooga 2, Tenn., gives specifications and basic features of Cavalier **electric heaters** plus a brief discussion of the advantages of automatic electric heat. Included are the two lines of the company's baseboard, both featuring safe thermal cutout and safe enclosed elements. The new wall insert heaters with totally enclosed cordierite ceramic heating elements and Kwik-Tatch heaters that hang on the wall like a picture are included in the bulletin, No. PC-1245.

Write B-840 on reply card, pg. 17

A new ten-page catalog describes the complete line of **exhaust fans, blowers, and ceiling heaters** of the **Emerson-Pryne Co.,** 8100 Florissant Ave., St. Louis 36, Mo. Covering new square exhaust fans and several new ceiling heaters, the catalog also features an illustrated index page for fast reference and a brief, illustrated discussion on the advantages of square fan design.

Write B-841 on reply card, pg. 17

A deluxe plastic bound catalog describing 300 models of built-in and portable **electric heaters** has just been prepared for architects, engineers, and electrical contractors by **Markel Electric Products, Inc.,** 145 Seneca St., Buffalo 3, N. Y. A built-in electric heater for almost every conceivable application can be found in the new 30-page catalog. Dimensions and specifications are given.

Write B-842 on reply card, pg. 17

A new **heat control catalog,** just released by **Mears Controls, Inc.,** P. O. Box 3798, Portland 8, Oreg., gives detailed description and illustrations of their complete line of thermostats for the control of electric heating. Included are wall-mount "decorator" thermostats, as well as built-in and water heat styles. This new edition also contains a section on common electric heating terms and their definitions.

Write B-843 on reply card, pg. 17

A brochure now available from **Perfect-Line Manufacturing Corp.,** Old Country Rd., Hicksville, N. Y., describes the company's **cable suspension system,** connectors, and accessories, with illustrations and specifications. Also included are step by step instructions on how to install a cable suspension system.

Write B-844 on reply card, pg. 17

A recently issued 48-page "Lighting Maintenance Manual" from **Champion Lamp Works,** Lynn, Mass., lays down basic rules for good **lighting and maintenance.** Types of lighting, their advantages, shapes of equipment, and lighting planning are a few of the topics covered. The illustrated manual is also indexed.

Write B-845 on reply card, pg. 17

Westinghouse 100-ampere **bus duct** is described and illustrated in an eight-page bulletin now available from **Westinghouse Electric Corp.,** Standard Control Div., Beaver, Pa. Shown are ways the benefits of conventional bus duct—flexibility of application, reuse, frequent plug-in openings, etc.—can be obtained for installations where smaller blocks of power are used.

Write B-846 on reply card, pg. 17

General Electric, Schenectady 5, N. Y., has released bulletin GED-4152, four pages, which gives the latest significant achievements in the art of **motor control centers.** This four-color bulletin discusses the more than 40 new General Electric control center features emphasizing protection of personnel and equipment, installation facility, over-all adaptability to meet changing industrial requirements, and ease of maintenance.

Write B-847 on reply card, pg. 17

System voltage

(Continued from page 79)

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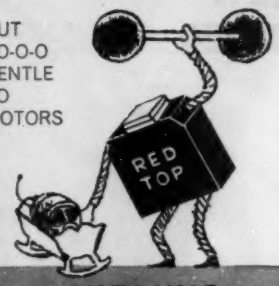

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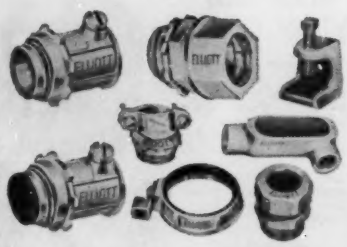

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transmission system to the load and maintain steady state stability is dependent on the field excitation.

Figure 6 is a diagram of the system being considered. X_e is the equivalent system reactance external to the generator. The voltage e_r is at a point in the system where voltage is constant. X_d is the station synchronous reactance and E_s is sending voltage back to X_d. Generator terminal voltage e_t is varied by changing excitation.

Assume the initial operation of the generator is as pictured in Figure 7-A. The generator load current "i" is at a lagging power factor θ so that the generator is operating in the overexcited region. If the power is maintained constant at the machine terminals and the terminal voltage is decreased until a point is reached when the voltage E_s behind the generator synchronous reactance leads the receiving end voltage e_r by 90 degrees, the station generators are at a steady state stability limit.

The machine operating at the steady state stability limit, sometimes called the "pullout" point, is pictured in Figure 7-B.

The station power output for the condition of Figure 7-B is $P = e_t\, i \cos \theta$. Assuming a value of e_t, and with e_r constant, P and Q can be calculated. A locus of points is obtained for underexcited operation of station generators at various assumed values of generator terminal voltage to maintain steady state stability (Figure 8).

Equations have been developed* for calculating P and Q when the machine is operating at the stability limit for a given value of receiving end voltage e_r, and generator terminal voltage e_t.

$$P = \frac{e_r}{X_e}\sqrt{e_t^2 - \left(\frac{e_r X_d}{X_d + X_e}\right)^2}$$

$$Q = \frac{1}{X_e}\left(e_t^2 - \frac{e_r^2 X_d}{X_d + X_e}\right)$$

Figure 8 shows the station gross machine capability curves upon which is superimposed the steady state stability limit for the normal transmission system X_e and a receiving end voltage $e_r = 1.0$ p.u. The steady state stability limit values were computed from the formulas given on the previous page.

Similar curves can be obtained for X_e', which is representative of the transmission system for line outage conditions and for different values of e_r which characterize other system operating conditions.

This analysis will dictate which machines have the ability to absorb vars during periods of leading p.f. load. In the example of Figure 8, the generator terminal voltage reaches its lower limit before the steady state stability limit or pullout is reached, provided the system is operating normally as represented by the system reactance $X_e = .128$ p.u.

*H. C. Anderson, H. O. Simmons, Jr., C. A. Woodrow. "System Stability Limitations and Generator Loading," *Power Apparatus and Systems.* (New York, Amer. Inst. Elect. Engrs., June 1953) p 416.

Bare hands

(Continued from page 67)

continue to do so until experience shows that it will be absolutely safe to lengthen this test period. The liners are quite an improvement over the fiberglass reinforced plastic baskets, requiring no downtime of the aerial device itself for making tests and repairs as was required when the baskets themselves were the insulation.

For electric utilities that have transmission lines which cannot be taken out of service for maintenance and repairs, the "bare hands" technique is an acceptable method of doing this work provided, of course, that the boom of the aerial basket device being used has satisfactorily passed an AC Hi Pot test of sufficient magnitude to insure its safety.

However, the use of such a technique on distribution voltages where another phase or ground wire is within reaching distance of the lineman when he is working one phase hot presents an entirely different problem. It doesn't take much imagination to see what would happen if the lineman should forget to disconnect the metal platform on which he is standing before he reaches over to work on the next phase wire.

Nor is it difficult to picture what would happen in the case of a two-basket unit where one man is connected to "A" phase and the other to "C" phase and one lineman asks the other lineman to hand him a wrench or piece of material.

We sincerely hope that electric utility companies now using or contemplating using aerial basket devices for hot line work will give

this problem their most careful consideration when establishing working rules and safety regulations.

Post lamps

(Continued from page 58)

of residences on or near the patios. People like to have a place to plug in their barbecue grills and braziers, and often the receptacle is used to plug in additional outside lights when they are entertaining."

Although this is only the second year that the electrical contractor has been going after sales and installations of the electric post lamps, he expects to show an impressive increase over the first year, and especially in the conversion of gas to electric post lamps.

Baseboard units

(Continued from page 46)

them and hire an electrical contractor to hook them up. The electrical contractor makes his profit, roughly 35 per cent, on the sale.

"Baseboard heating implies to most homeowners that the installation involves carpentry or masonry work, with the ensuing cost and muss. Fact is, we went on one job and found the baseboards removed for us. We had to wait until they were replaced.

"The homeowner just can't conceive self-contained heating units that can be fastened directly to their baseboards and hooked up to the service with no mess or fuss."

The extra net profit of $200 or more which can be picked up from a residence wiring job provides a new opportunity for the electrical contractor.

Code rules

(Continued from page 54)

including pushbuttons, relays, and similar control devices, are required to be provided with tight metal enclosures designed to minimize the entrance of fibers and flyings and equipped with telescoping or tight fitting covers which will effectively prevent the escape of sparks or burning material and which have no openings through which, after installation, sparks or burning material could escape or through which adjacent combustible material could be ignited. Mounting holes, if any, must be in outside appendages.

Section 503-5 requires that transformers, impedance coils, and resistors which are used as, or in conjunction with, control equipment for motors, generators, and appliances comply with the following rules:

(1) Where not installed in the same enclosure with switching mechanisms, control transformers and impedance coils are required to be provided with tight metal housings without ventilating openings. Resistors are required to be provided with dust-ignition-proof enclosures approved for Class II locations except as follows: Where the maximum normal operating temperature will not exceed 120 C, non-adjustable resistors and resistors which are a part of an automatic time-sequence starting device may be provided with tight metal housings without ventilating openings.

(2) In Class III, Division 1 areas when such transformers, impedance coils, and resistors are in the same enclosure with control switching devices and where they are used only for starting or for short-time duty, they are required to be provided with tight metal enclosures which are designed to minimize the entrance of fibers or flyings and which have telescoping or tight fitting covers which effectively prevent the escape of sparks and burning material and which have no openings, such as holes for attachment screws, through which, after installation, sparks or burning material could escape or through which adjacent exterior combustible material could be ignited.

Answers to Code test questions: (1. **T** Section 502-14-a-1) (2. **T** Section 502-14-a-2) (3. **F** Section 502-14-a-3) (4. **T** Section 502-14-b-2) (5. **T** Section 502-14-a-5) (6. **a** Section 503-3-a) (7. **a** Section 503-3-b) (8. **c** Sections 503-1 and 500-6) (9. **b** Section 503-1) (10. **c** Section 503-3-a-1).

High school heat

(Continued from page 44)

From experience, he makes these suggestions to others who may be planning electric heat in schools: be sure that each classroom has two thermostats, be sure that one of these thermostats is near the outside wall, give particular attention to any classrooms facing

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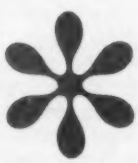

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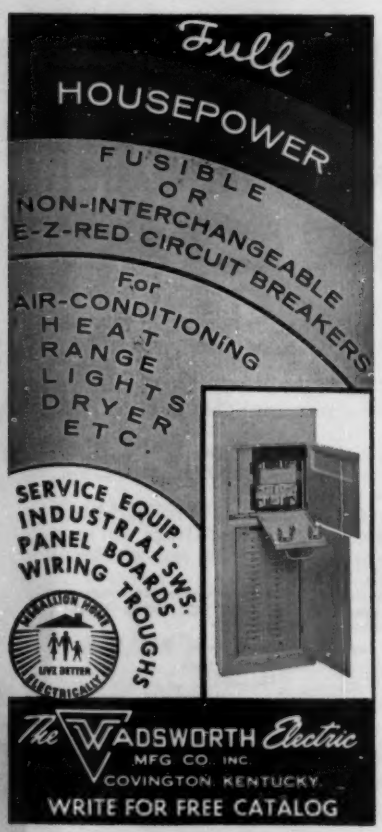

north, make certain that the thermostats are placed correctly, and be sure to install breakers of adequate size.

Estimated power costs per year for a 30-classroom all-electric school include space heating, $2,-920.50; lighting $1,702.50; cooking, $754.50; water heating, $1,630.50; total, $6,999.

For space heating alone, the estimated cost is January, $601; February, $501; March, $296; April, $181; October, $181; November, $397; December, $501. For June, July, and August the estimate is $87.50 each on the prorated minimum bill.

There are *actual* figures available for other schools. At Motley Elementary School, Lowndes County, Miss., there are nine classrooms plus cafetorium, office, lounge, clinic, music room, and kitchen. There, industrial type suspension mounted heaters are used in classrooms and the cafetorium. No heaters were installed in corridors and rest rooms. Wall convectors were used in the office, clinic, and lounge.

The electric service is 120/240-volt single-phase, 930 amperes. The connected load is lighting, 75.0 kw; water heating, 4.5 kw; space heating, 96.0 kw; kitchen, 20.0 kw; miscellaneous power, 5.0 kw. The cost for 112,050 kwh in a year was $1,677.31. By months, the cost ranged from $1.35 in July to $322.29 in December. The average cost per kwh was 1.495¢.

Supt. J. Craft Akard of Sullivan County schools, Blountville, Tenn., was pleased with an electrical heating system at Colonial Heights Elementary School. He feels the cost over a period of years will be justified by three factors: "the initial savings in cost of construction by eliminating boiler room and pipes; reduction in maintenance cost, painting in particular; and the pleasant uniform heat which is so easily regulated."

Apartment heat

(Continued from page 38)

they are controlled by wall-mounted thermostats.

Electric baseboard was selected over other forms of electric resistance heaters because it was more applicable to the physical characteristics of the building, and the builder stated it offered greater sales features as well as maintaining the atmosphere the builders were striving to build into the Belvedere. Electric baseboard met the test and is an unqualified success.

The apartments are large, two and three bedrooms, with an average floor area of 1,000 square feet. Owing to the location, on Clearwater Bay, the architect was very generous in the use of glass, with each apartment having a glassed-in living room or porch. This factor created an abnormal heat loss figure and could conceivably cause out-of-reason operating costs. But careful placement of baseboard heating sections and indoctrination of owners in the use of individual room thermostats solved these problems.

To this point we have examined some of the physical characteristics of the Belvedere building, but nothing in the way of operating figures. A great deal has been said and written about heating with electricity and the cost of operating it—much of it distorted.

Several apartments in the Belvedere have been selected, at random, and operating costs compiled for the heating season of 1959-1960. The estimated cost of operation is shown in Table I, and, considering the human factor and an increase of 37 per cent in degree days, the estimates turned out very good.

All of the owners were more than satisfied with the first winter's operating costs and especially so with the comfort and cleanliness.

Clearwater Construction Co., general contractor for the Belvedere, stated this was their first electric baseboard heat venture, and that they would be back for more. They were especially pleased with the cost of installation since it was less than a conventional fossil fuel heating system. They also liked having the heating contract included in the electrical subcontract.

McGee Electric Co., the sole electrical contractor on the Belvedere, has been a strong supporter of electric heating for several years. This job was the largest heating job that McGee had done, up to that time, and it justified their faith in the electric heating field.

Infrared heat

(Continued from page 37)

Although they were well aware of their comfort, most of the spectators did not know the source of the heat. Understandably, most of them thought the Luminator heating fixtures were lighting units

because of the "golden" light rays they project.

With all the fixtures turned on, for instance, there are 150 footcandles of light on the playing floor, making Greenville's gym one of the best lighted in the country. The standard recommendation for college gyms is 50 footcandles, 30 for high schools.

In all, 50 infrared fixtures are used in the Greenville College installation. Twenty of these are single-lamp fixtures, the balance are equipped with two infrared lamps each. The fixtures are positioned in rows along the ceiling and each row contains a type of fixture with reflectors specifically designed to direct or spread infrared heat over a particular area or zone of the floor below.

This important design feature of the fixtures allows the concentration of more heat on spectator seating, for instance, than on the playing area of the floor, where less heat is needed. The fixtures are also specially designed to reduce glare in the range of vision to a comfortable level.

Additional flexibility is built into the installation's control system. For players who are working up a lot of body heat, as few units as needed may be turned on over the playing area. At the same time, as many units as are needed can be turned on over the bleachers so that spectators are comfortable.

The controls also make it possible to heat either end of the floor when side baskets are hydraulically lowered for intramural basketball games. Over-all the system was engineered to provide enough heat so that people inside the building would be comfortably warm even if the air temperature fell to minus ten F.

Since it warms people and objects instead of the surrounding air, the comfortable warmth of radiant heat is felt the moment the units are turned on. Even with all units operating, however, players and spectators continue to breathe cool air, another advantage that adds to their comfort.

The infrared heating system is also very clean, completely automatic, and takes up very little space as compared with other methods of heating.

The system also had a few extra advantages not anticipated by Greenville College officials. The gymnasium flooring contractor, for example, said the floor's finish was the best he had ever achieved. The application of the finish on warmed wood and the drying effect of the radiant heat made this possible.

When the new heating system's efficiency is considered in the light of dollars and cents savings, the results are equally impressive. Operating costs for the entire 1960-61 winter heating season were less than $2,000; approximately $600 less than initially estimated and equal to or less than estimated costs for other methods of heating that might have been used in the new building. In addition, the system furnished four to five months of free lighting worth approximately $500.

With a load of 190 kw, the gym system qualified for Illinois Power Company's advantageous high-use rate—an important economy factor for the college.

According to Luminator, Inc., the Greenville college installation conclusively proves the practicability of using electric infrared heating in high-bay buildings usually difficult and expensive to heat by conventional methods.

"Based on the overwhelming success of this high-bay installation," say Luminator engineers, "we feel a large number of similar institutional as well as commercial and industrial installations will be completed this year."

Heat index

(Continued from page 35)

is $14,380, or $80 more. The increase in the down payment is $8, and the increase in the mortgage is therefore $80 minus $8, or $72.

The monthly reduction in fuel cost because of this insulation is $2.83, and the increase in monthly mortgage payments to pay for the insulation is $.47. Thus there is a reduction in monthly housing expense of $2.36, or $2.83 minus $.47.

Therefore, according to the FHA, there is a $200 possible reduction in the buyer's annual income without lowering the rating of the buyer's ability to pay for a home.

Home heat

(Continued from page 35)

use of the residence by its owners. In each of the 17 rooms a room thermostat controls one or more silent mercury switch type relays

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(August, 1961)

For more details on above items, use reply card on page 17

which in turn control the operation of electric heating coils.

Six rooms have a single-stage thermostat which maintains even temperatures by controlling the electric coils in the floor. Other thermostats are of the two-stage type, to control the floor coil and the ceiling coil in sequence.

In rooms where two-stage thermostats control floor and ceiling heat, the floor heat comes on first, and then the ceiling comes on. The ceiling coils are necessary because these rooms have higher heat losses.

An adjustable time clock places the control of the electric heaters under two night thermostats, one located in the living quarters, the other in the sleeping area. The seven-day clock is set to go on at 3 p.m. Friday and cuts off at 9 a.m. Monday. The house is warm upon the arrival of its occupants for a weekend, and cools upon their departure.

Night thermostats maintain a lowered night temperature in accordance with the setting of the time clock. Manual switches are provided to override the operation of the time clock during unoccupied periods or at such times when lowered night temperature is not desired.

Each of the 17 thermostats in the house has manual control so that temperature may be adjusted to individual needs.

The system comprises two 200-ampere underground services, one 115-230-volt single-phase system, and one 115-230-volt three-phase system. Total wattage installed is 50,020. There are two main heating distribution panels, 12 subpanels, and 25 relays.

We have had reports from the customer during the past winter season that he is very much satisfied with heating results and finds operational costs lower than he anticipated.

Certified heat

(Continued from page 33)

for one year only. To retain certification, they must attend classes and pass examinations in each succeeding year.

The requirements were made rigid to assure all segments of the industry and the public that their confidence in the certification program is merited. We believe that a certification program reduced merely to an advertising slogan would be a deceit and useless.

We started our certified electric heating program not through the participating contractors but through the public—who will be the greatest benefactor—with an 80-foot exhibit at the Florida State Fair in Tampa last February.

The display explained the purpose, extent, and meaning of certification in providing the most responsible and effective workmanship and know-how at the lowest possible cost. Brochures handed out to fair visitors and newspaper advertisements repeated this message, listing names of the first certified contractors.

Thus, a public demand for certified service and public confidence in the program was created even before its benefits were offered.

This opening campaign was followed in March by the first certification school, attended by more than 65 contractors and their employees. A second school, made up of three two-hour sessions, plus required reading, was scheduled for September.

The FAEC Tampa Chapter is most fortunate to have as its instructor "Professor" James Yost, residential heating specialist of the Tampa Electric Co., the support and advice of TECO's residential sales staff, plus a slide rule type of heat loss calculator, developed especially for the Florida climate.

Already we see our certification program working well for us on two fronts. It has greatly lifted the morale and enthusiasm of our members. The public confidence it has generated is immeasurable.

Although a group certification program, I believe, is the best approach to our new opportunity, individual contractors to whom such a program is unavailable can still stay abreast of rapidly moving developments through individual effort.

I would suggest to them that they read everything they can on electric heating. Hundreds of pages of promotional and technical information have been printed in your trade magazines, by heating manufacturers, NEMA, NECA, EEI, SEE, and others.

EEI has prepared a complete electric heating course. NEMA has produced an electric heating manual with information on insulation and heat loss calculations. Your electric utility is prepared to guide you in figuring operating costs. Your supplier also can be helpful.

There is no valid reason for any earnest, intelligent contractor not getting out in front and staying there in the electric heating market with its forthcoming challenge, opportunity, and profit.

Members of the FAEC Tampa Chapter, I hope, will have had a part in showing you the way.

Washington news

(Continued from page 6)

There is possibility of a compromise. The committee is considering letting businessmen deduct eight per cent of investment in new buildings and equipment. But most likely prospect is no new tax legislation this year. Instead, consideration of major tax reform next year when the President has promised to put such a bill before Congress.

Business spokesmen hope that the bill will simplify the tax structure. The goal is to make the tax law so easy that anyone can understand it. Businessmen also hope for a major change in depreciation rates. They want to depreciate plant and equipment over shorter periods, thus recovering money faster and having more to reinvest to build business and the economy.

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